Prepared by:
NH Department of
Environmental Services
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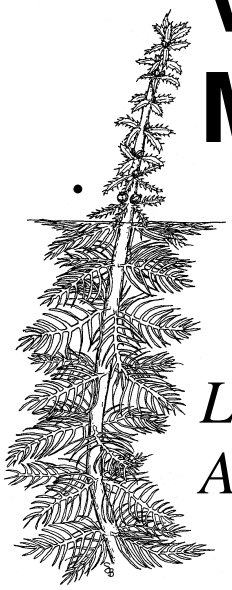
Long-Term Variable Milfoil Management Plan



Lake Winnipesaukee
Alton, New Hampshire

Contents

Purpose

The purposes of this exotic aquatic plant management and control plan are:

1. To identify and describe the historic and current exotic aquatic infestation(s) in the waterbody;
2. To identify short-term and long-term exotic aquatic plant control goals;
3. To minimize any adverse effects of exotic aquatic plant management strategies;
4. To recommend exotic plant control actions that meet the goals outlined in this plan; and
5. To recommend monitoring strategies to determine the success of the control practices over time in meeting the goals.

This plan also summarizes the current physical, biological, ecological, and chemical components of the subject waterbody as they may relate to both the exotic plant infestation and recommended control actions, and the potential social, recreational and ecological impacts of the exotic plant infestation.

The intent of this plan is to establish an adaptive management strategy for the long-term control of the target species (in this case variable milfoil) in the subject waterbody, using an integrated plant management approach.

Appendix A and Appendix B detail the general best management practices and strategies available for waterbodies with exotic species, and provide more information on each of the activities that are recommended within this plan.

Invasive Aquatic Plant Overview

Exotic aquatic plants pose a threat to the ecological, aesthetic, recreational, and economic values of lakes and ponds (Luken & Thieret, 1997, Halstead, 2000), primarily by forming dense growths or monocultures in critical areas of waterbodies that are most used for aquatic habitat. These dense growths and near monotypic stands of invasive aquatic plants can result in reduced overall species diversity in both plant and animal species, and can alter water chemistry and aquatic habitat structure that is native to the system.

Since January 1, 1998, the sale, distribution, importation, propagation, transportation, and introduction of key exotic aquatic plants have been prohibited (RSA 487:16-a) in New Hampshire. This law was designed as a tool for lake managers to help prevent the spread of nuisance aquatic plants.

New Hampshire lists 27 exotic aquatic plant species as prohibited in the state (per Env-Wq 1303.02) due to their documented and potential threat to surface waters of the state.

According to the federal Section 305(b) and 303(d) Consolidated Assessment and Listing Methodology (CALM), "exotic macrophytes are non-native, fast growing aquatic plants, which can quickly dominate and choke out native aquatic plant growth in the surface water. Such infestations are in violation of New Hampshire regulation Env-Wq 1703.19, which states that surface waters shall support and maintain a balanced, integrated and adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of similar natural habitats of a region" (DES, 2006). In fact, waterbodies that contain exotic aquatic plant infestations do not attain water quality standards and are listed as impaired.

Variable Milfoil Infestation in the Alton Bay Area of Lake Winnipesaukee

Variable milfoil became established in the Alton Bay area and nearby coves of Lake Winnipesaukee in the late 1960s as it spread from other areas of the lake. It is currently found in dense patches around many of the shoreline areas of Alton Bay and coves along the western shoreline of the lake in Alton, as well as upstream in the Merrymeeting River that flows into Alton Bay from the south.

Figure 1 illustrates the extent of the variable milfoil infestation in Alton Bay over time since routine monitoring began.

The following table provides a summary of each area indicated in Figure 1.

Area	Location/Area Description	Year	Description of Growth
A	Smalls Cove- This is a narrow shallow cove of Lake Winnipesaukee that has an inlet channel flowing in (though there are no upstream sources of milfoil coming in from the stream). A high-use marina is located in this cove, as is a commercial lake construction firm. Ingress/egress is high and milfoil grows in many areas of this cove and tops	2012	Variable milfoil growth is primarily concentrated at the marina and around the construction company's docks, though scattered patches of growth are present in the channel connecting the cove with the main body of the lake.
		2013	Milfoil expansion in this area since 2012
		2014	Reduced density variable milfoil observed, now present as scattered patches in some

Area	Location/Area Description	Year	Description of Growth
	out at the surface of the water.		locations of marina, as shown on survey map
		2014	
B	Minge Cove- Minge Cove is a shallow cove on the west side of Lake Winnipesaukee. The cove is approximately 15 acres in size. There are a few homes around the shoreline of the cove, and a marina located in the back of the cove with several docking systems, a boat launch and gas station.	2012	Variable milfoil growth has covered roughly 3 acres of this cove, mainly in the back basin around the marina docks. In recent years integrated approaches at management have kept biomass low.
		2013	No variable milfoil observed due to herbicide treatment and dive work
		2014	A couple of stems of milfoil observed
		2015	Scattered stems of milfoil observed
C	Woodmans Cove- This is a roughly 11.6 acre cove on the western side of Alton Bay. It is shallow with sandy and rocky substrate and to islands.	2012	Variable milfoil growth in this cove covers a very small area (<1/4 acre) in shallow water; unfortunately it is in the opening of a boat docking area and transient boating through the area causes much fragmentation to occur in the 1-2 foot depth water.
		2013	No variable milfoil observed due to good management by divers
		2014	No variable milfoil observed
		2015	A couple stems of variable milfoil observed
D	Sandy Point- this small cove on the southwestern side of Alton Bay is sandy with scattered small rocks.	2012	Variable milfoil is present as only a few scattered stems in this area.
		2013	No variable milfoil observed
		2014	No variable milfoil observed
		2015	No variable milfoil observed
E	Rand Cove- This 5.5 acre cove on the west side of Route 11 from Alton Bay is roughly 15 feet deep (max) with sandy substrates. A small cluster of houses is present around the cove. There is a swim beach and several docking areas in the cove.	2012	Variable milfoil has been a consistent problem in most of Rand Cove over the years. There is much regular ingress and egress to Lake Winnipesaukee occurring and fragments move back and forth between Rand Cove and the main lake. Milfoil growth has covered much of the cove in the past.

Area	Location/Area Description	Year	Description of Growth
		2013	Scattered stems and patches, managed by diving
		2014	Scattered stems and patches, managed by diving
		2015	Expanded patches needed herbicide treatment in spring
F	Alton Bay South- This section covers mainly the very southern tip of Alton Bay, where restaurants, marinas and some houses are present along the shoreline. Depths range from an average of 5 feet along shore to a maximum of 20 feet in the middle of this area. This section of the lake is subject to many milfoil fragments floating in from the Merrymeeting River.	2012	Variable milfoil growth has been thick from shore to a depth of approximately 10 feet in this area, forming a band around shore and posing problems for marinas, swim beaches and places of business with docking structures. Milfoil growth is thick and fragments readily as a result of the recreational uses in the area. Milfoil growth has covered between 5-6 acres around the shoreline/shallow areas of the southern part of the bay.
		2013	Scattered patches of growth managed by divers
		2014	Reduced variable milfoil compared to prior years
		2015	Reduced variable milfoil compared even to 2014
G	Parker Marina	2012	This is a marina area just before the mouth of the Merrymeeting River where it inters Alton Bay. The marina has several boat slips and milfoil growth is present around the slips and boats in the marina.
		2013	Dense growth throughout marina
		2014	Dense growth throughout marina, though somewhat reduced compared to prior years
		2015	Herbicide treatment and other work in river appears to be reducing the variable milfoil in the marina, though more work is needed
H	Merrymeeting River- The Merrymeeting River enters Lake Winnipesaukee at the	2012	Much of the 17 acres of river from the dam in Alton to the mouth of Alton Bay is infested with variable milfoil.

Area	Location/Area Description	Year	Description of Growth
	southern tip of Alton Bay. From the dam to the mouth of Alton Bay the river covers approximately 17 acres in area.		Milfoil is thickest in wetlands along the river and along the shoreline area, and less dense in the narrow mainstem of the river (center of channel).
		2013	Dense areas of growth along river, being managed intensively by diving
		2014	Dense areas of growth along river, being managed intensively by diving
		2015	Dense areas of growth along river, being managed intensively by diving, cleared channel and reduced growth
I	Robert's Cove, located in the northeastern portion of Lake Winnipesaukee within the Town of Alton	2012	Variable milfoil dense around docks and open water area of marina, as shown in inset map in Figure 1, for the northern section of Alton
		2013	Variable milfoil dense around docks and open water area of marina, as shown in inset map in Figure 1, for the northern section of Alton
		2014	Herbicide treatment followed by diving greatly reduced the variable milfoil in this area
		2015	No variable milfoil observed

In terms of the impacts of the variable milfoil in the system, there are two public beaches, several marinas and business and several hundred homes that are along the shoreline of Alton Bay and other areas of Lake Winnipesaukee that fall within the Town of Alton. Areas where milfoil growth occurs are fouled with generally dense stands of milfoil growth. Town officials and members of the Alton Milfoil Committee indicate that fishing, swimming, paddling, jet skiing, and hydro-biking activities, among others, are impaired in thick areas of milfoil growth.

Milfoil Management Goals and Objectives

Because of the expansive size of the overall variable milfoil infestation within Lake Winnipesaukee, DES recognizes that eradication of variable milfoil in the lake system as a whole is unlikely, both due to the degree of fragmentation of the plants and subsequent spread, but also due to the overall cost of attempting a lake-wide eradication project on this lake.

While many towns around Lake Winnipesaukee are becoming more active in holistic lake management and milfoil reduction activities, including the Town of Alton, this specific plan will focus on the goal of reducing the overall milfoil density and distribution in Alton Bay and nearby coves and shoreline areas of the lake that fall within the Town of Alton. The portion of the Merrymeeting River below the dam in Alton is also an area of focus included in this plan as the milfoil in that river segment is contiguous with the milfoil in Alton Bay, but efforts in this area are limited due to density of milfoil growth and proximity of town water supply wells which limit herbicide use in parts of the river.

For Alton Bay, DES proposes to work with the Town of Alton to perform variable milfoil management practices to minimize the recreational, ecological, human health, business, and aesthetic impacts caused by dense growths and to prevent further spread of this invasive plant, while maintaining the overall integrity of native plant communities whenever variable milfoil control actions are being implemented.

Local Support

Town or Municipality Support

The Town of Alton Recreation Department and Milfoil Committee are taking the lead both financially and actively for this project.

Lake Association Support

There is no formal singular lake association for Alton Bay. The Town of Alton has developed a Milfoil Committee to coordinate activities relative to variable milfoil control within waterbodies in the town and this group meets and strategizes on a regular basis throughout the year.

Waterbody Characteristics

The following table summarizes basic physical and biological characteristics of Alton Bay area of Lake Winnipesaukee, including the milfoil infestation. Note that a current review of the Natural Heritage Bureau (NHB) database was requested and the results from that search are included here, along with any historic species that have been listed in past NHB reviews.

Table 1 summarizes basic physical and biological characteristics of the portion of Lake Winnipesaukee that falls within the Town of Alton.

General Lake Information	
Area of Alton Bay (acres)	1,353.3+
Shoreline Uses (residential, forested, agriculture)	Residential, commercial, beaches, some forested
Max Depth (ft)	~120
Trophic Status	Oligotrophic
Color (CPU) in Epilimnion	9
Clarity (ft)	30.3
Invasive Plants (Latin name)	*Myriophyllum heterophyllum*
Infested Area (acres)	See figures
Distribution (ringing lake, patchy growth, etc)	See figures
Sediment type in infested area (sand/silt/organic/rock)	Sandy, rocky, silty depending on specific areas
Rare, Threatened, or Endangered Species in Waterbody (according to NH Natural Heritage Bureau (NHB) Inventory)	2016 Revies Bald Eagle (*Haliaeetus leucocephalus*) Common Loon (*Gavia immer*) Osprey (*Pandion haliaetus*) Species Listed in Historic NHB Reviews Flatstem Pondweed (*Potamogeton zosteriformis*) Purple Martin (*Progne subis*)

A native aquatic vegetation map and key from an August 2009 survey (field checked annually, no significant changes noted) by the DES Biology Section is shown in Figure 2. A bathymetric map is shown in Figure 3.

Beneficial (Designated) Uses of Waterbody

In New Hampshire, beneficial (designated) uses of our waterbodies are categorized into five general categories: Aquatic Life, Fish Consumption, Recreation, Drinking Water Supply, and Wildlife (CALM).

Of these, Aquatic Life, Wildlife and Recreation are the ones most often affected by the presence of invasive plants, though drinking water supplies can also be affected as well in a number of ways.

Following is a general discussion of the most potentially impacted designated uses, including water supplies and near shore wells, as they relate to this system and the actions proposed in this long-term plan.

The goal for aquatic life support is to provide suitable chemical and physical conditions for supporting a balanced, integrated and adaptive community of aquatic organisms having a species composition, diversity, and functional organization comparable to that of similar natural habitats of the region.

Aquatic Life

The principal fisheries of Lake Winnipesaukee include both warm and coldwater species. Coldwater species of primary interest are; landlocked Atlantic salmon, lake trout, and rainbow trout. Other cold water species include lake whitefish, round whitefish (species of concern in Wildlife Action Plan), burbot, brook trout, and rainbow smelt.

Warmwater species of primary interest are; largemouth bass, smallmouth bass, white perch, yellow perch, chain pickerel, black crappie, brown bullhead, and bluegill. The bass fishery is extremely popular with anglers as numerous fishing tournaments are held on the lake each year.

Numerous warmwater species are present in littoral areas of the lake and constitute the prey fish sought by larger gamefish (warmwater). These species include; banded killifish, common shiner, common white sucker, creek chubsucker, bridle shiner (species of concern in Wildlife Action Plan), fallfish, golden shiner, pumpkinseed, redbreast sunfish, rock bass, slimy sculpin, and yellow bullhead.

The American eel, a catadromous species, reside up to 4-9 years in our inland lakes, such as Lake Winnipesaukee, where they reach sexual maturity and migrate down the rivers and outlets of our large lakes to the Atlantic Ocean.

Wildlife

Bald eagle: There are several locations of bald eagle sightings in and near Alton. The Fish and Game Department has requested that contractors avoid using loud boats or equipment (particularly airboats) within 100m of any occupied eagle next.

Common loon: Loons are found in many areas of Lake Winnipesaukee. DES has encouraged the town to make contact with the Loon Preservation Society, so that they can be notified of the proposed control activities. In the past, a Loon Preservation Society representative has been on site to observe herbicide treatments in loon habitat on other waterbodies. These representatives carry handheld radio to communicate with the applicator during the treatment of the

subject areas. The loon staff member monitors the behavior of the loons (if they are in the area), and directs the actions of the applicator so as to minimize any stress on the loons. The herbicides that are used are not toxic to the loons at the dose used to control milfoil, so toxicity effects are not an issue. The Fish and Game Department does request that herbicide treatments not be permitted within 100 meters of any nests. Their cited concern is that the method of application, by motorboat and/or airboat, may result in nest abandonment and loss of eggs and/or loon chicks, as well as herbicide damage to the floating aquatic plants. They further request that non-chemical means of control, such as hand pulling, be set back 100 meters from any known or suspected loon nests during the period of May 15 and July 15th, to avoid "take" under RSA 212-Aof the Endangered Species Conservation Act.

Osprey (*Pandion haliaetus*): The osprey is listed as a species of concern in New Hampshire, though globally it is widespread, abundant and secure. The primary food for the osprey is fish. These birds are extremely territorial and do not stray too far from the nest. As the herbicides of choice do not bioaccumulate to toxic levels in the fish, or biomagnify along the food chain, impacts to the osprey as a result of the herbicide treatment are unlikely. It is also unlikely that targeted non-chemical controls of the variable milfoil will affect osprey in the area.

Purple Martin (*Progne subis*): The purple martin is listed as a species of concern in New Hampshire, but it does not hold a specific ranking due to lack of information on the species. We do not anticipate the herbicide treatment or non-chemical controls of variable milfoil will affect this avian species.

Figure 5 shows a map of species distribution, as provided by historic NHB reviews.

Recreational Uses and Access Points

Alton Bay is used for numerous recreational activities, including boating, fishing, swimming, and water skiing by both lake residents and transient boaters. Additionally, on Alton Bay there are places of business, including marinas, restaurants, and other shops. There is a public access site on the western side of the lake, and access can also be achieved at area marinas. In 2013, the Fish and Game Department purchased a parcel previously held by Downing's Landing, and plans are to make this access area open to the public.

The two public beaches and numerous businesses along Alton Bay are of interest for this exotic aquatic plant control project, as are the coves with various infestations that affect residential shorefront uses of the waterbody.

There are two public ("designated") swim areas within Alton Bay. A designated beach is described in the CALM as an area on a waterbody that is operated for bathing, swimming, or other primary water contact by any municipality, governmental subdivision, public or private corporation, partnership, association, or educational institution, open to the public, members, guests, or students whether on a fee or free basis. Env-Wq 1102.14 further defines a designated beach as *"a public bathing place that comprises an area on a water body and associated buildings and equipment, intended or used for bathing, swimming, or other primary water contact purposes. The term includes, but is not limited to, beaches or other swimming areas at hotels, motels, health facilities, water parks, condominium complexes, apartment complexes, youth recreation camps, public parks, and recreational campgrounds or camping parks as defined in RSA 216-I:1, VII. The term does not include any area on a water body which serves 3 or fewer living units and which is used only by the residents of the living units and their guests.*

Figure 6 shows the location of public access sites and swim beaches of particular interest/concern with regards to the milfoil infestation and control actions.

Macrophyte Community Evaluation

The littoral zone is defined as the nearshore areas of a waterbody where sunlight penetrates to the bottom sediments. The littoral zone is typically the zone of rooted macrophyte growth in a waterbody.

The littoral zone of the bay is characterized by a mix of native and non-native (variable milfoil) plant growth (Figure 2). Native species include a mix of floating plants (yellow and white water-lilies, floating leaved pondweeds, and water shield), emergent plants (bur-reed, pickerelweed), and submergent plants (bladderwort, pondweed). Native plant communities are mixed around segments of the bay, and are characterized as 'sparse' for the bay.

In historic NHB reviews, flatstem pondweed (*Potamogeton zosteriformis*) has been identified in the Merrymeeting River upstream of Alton Bay. The plant is listed as endangered in NH due to pollution, runoff and water level changes. The NHB record is from 1970. DES verified the presence of the species in a cove and marina area in the Merrymeeting River, but not in other areas of Alton Bay. As this pondweed is a monocot it will not likely be impacted by the proposed herbicide treatment, and divers working in the area will be advised to avoid any existing populations of this plant in their hand-removal efforts for variable milfoil. The plant was not listed in the 2014 NHB review because it has not been documented in the specific areas targeted for milfoil management; however, the record is being recognized here as if milfoil populations are reduced, the pondweed may expand its population once again

in the river, as it is documented upstream in a small nearby portion of the Merrymeeting River.

Wells and Water Supplies

Figure 7 shows the location of wells, water supplies, well-head protection areas, and drinking water protection areas around the Alton Bay Area, Lake Winnipesaukee, based on information in the DES geographic information system records. Note that it is likely that Figure 7 does not show the location of all private wells.

Note that the map in Figure 7 cannot be provided on a finer scale than 1:48,000. Due to public water system security concerns, a large-scale map may be made available upon agreement with DES's data security policy. Visit DES's OneStop Web GIS, http://www2.des.state.nh.us/gis/onestop/ and register to Access Public Water Supply Data Layers. Registration includes agreement with general security provisions associated with public water supply data. Paper maps that include public water supply data may be provided at a larger-scale by DES's Exotic Species Program after completing the registration process.

In the event that an herbicide treatment is needed for this waterbody, the applicator/contractor will provide more detailed information on the wells and water supplies within proximity to the treatment areas as required in the permit application process with the Division of Pesticide Control at the Department of Agriculture. It is beyond the scope of this plan to maintain updated well and water supply information other than that provided in Figure 7.

Due to the proximity of Alton's drinking water wells near the Merrymeeting River, and the documented hydrologic connection of the wells to the river, herbicide treatment south (upstream) of the Parker Marina area is not likely feasible.

Aquatic Invasive Plant Management Options

The control practices used should be as specific to the target species as feasible. No control of native aquatic plants is intended.

Exotic aquatic plant management relies on a combination of proven methods that control exotic plant infestations, including physical control, chemical control, biological controls (where they exist), and habitat manipulation.

Integrated Pest Management Strategies (IPM) are typically implemented using Best Management Practices (BMPs) based on site-specific conditions so as to maximize the long-term effectiveness of control strategies. Descriptions for the control activities are closely modeled after those prescribed by the Aquatic Ecosystem Restoration Foundation (AERF) (2004). This publication can be found online at http://www.aquatics.org/bmp.htm. Additional information can be obtained from a document prepared for the State of Massachusetts called the Generic Environmental Impact Report for Lakes and Ponds, available at http://www.mass.gov/dcr/watersupply/lakepond/geir.htm.

Criteria for the selection of control techniques are presented in Appendix A. Appendix B includes a summary of the exotic aquatic plant control practices currently used by the State of New Hampshire.

Historical Control Activities

LOCATION	DATE	ACTION	AREA (ac) OR AMOUNT (GAL)	CONTRACTOR
WEST ALTON MARINA	6/7/82	DIQUAT	2	AQUATIC CONTROL
WEST ALTON MARINA	6/1/84	2,4-D (G)	2	AQUATIC CONTROL
WEST ALTON MARINA	6/8/93	2,4-D (G)	3.5	AQUATIC CONTROL
WEST ALTON MARINA	6/6/96	DIQUAT	3.5	AQUATIC CONTROL
WEST ALTON MARINA	6/16/99	DIQUAT	4	LYCOTT
WEST ALTON MARINA	6/7/00	DIQUAT	3.5	AQUATIC CONTROL
ISLAND MARINA, MINGE	6/12/01	DIQUAT	3	LYCOTT
WEST ALTON MARINA	6/13/01	2,4-D	3.5	AQUATIC CONTROL
ISLAND MARINA, MINGE	6/5/02	2,4-D	3	AQUATIC CONTROL
RAND COVE	6/5/02	DIQUAT	5.5	AQUATIC CONTROL
ISLAND MARINA, MINGE	6/8/04	2,4-D	3	AQUATIC CONTROL
RAND COVE	6/22/04	DIQUAT	5.5	AQUATIC CONTROL
ISLAND MARINA, MINGE	6/5/07	2,4-D	3	AQUATIC CONTROL
RAND COVE	6/5/07	2,4-D	3.35	AQUATIC CONTROL
ALTON TOWN BEACHES	6/19/07	2,4-D	2	LYCOTT

LOCATION	DATE	ACTION	AREA (ac) OR AMOUNT (GAL)	CONTRACTOR
ALTON TOWN BEACHES	8/29/08	DASH	3 HOURS, 250 GALLONS	DES AND DIVEMASTER DIVE SERVICES
ALTON TOWN BEACHES	9/4/08	DASH	2 HOURS, 190 GALLONS	DES AND DIVEMASTER DIVE SERVICES
ALTON TOWN BEACHES	9/5/08	DASH	3 HOURS, 280 GALLONS	DES AND DIVEMASTER DIVE SERVICES
ALTON TOWN BEACHES	9/11/08	DASH	3 HOURS, 300 GALLONS	DES AND DIVEMASTER DIVE SERVICES
ALTON TOWN BEACHES	9/19/08	DASH	3 HOURS, 290 GALLONS	DES AND DIVEMASTER DIVE SERVICES
ALTON TOWN BEACHES	10/3/08	DASH	3 HOURS, 280 GALLONS	DES AND DIVEMASTER DIVE SERVICES
ISLAND MARINA, MINGE	6/8/09	2,4-D (G)	3	ACT
ALTON BAY/LOWER MM RIVER	9/14/10	2,4-D (G)	11.5	LYCOTT
RAND COVE	9/14/10	2,4-D (G)	3.7	LYCOTT
WEST ALTON MARINA/SMALLS COVE	9/14/10	2,4-D (G)	8.25	LYCOTT
VARIOUS IN SOUTH PART OF ALTON BAY	10/15/11	DASH	6 HOURS, 260 GALLONS	AB AQUATICS, INC.
VARIOUS IN SOUTH PART OF ALTON BAY	10/24/11	DASH	8.5 HOURS, 360 GALLONS	AB AQUATICS, INC.
VARIOUS IN SOUTH PART OF ALTON BAY	10/25/11	DASH	7 HOURS, 280 GALLONS	AB AQUATICS, INC.
VARIOUS IN SOUTH PART OF ALTON BAY	10/28/11	DASH	2 HOURS, 60 GALLONS	AB AQUATICS, INC.
VARIOUS IN SOUTH PART OF ALTON BAY	10/29/11	DASH	1.5 HOURS, 80 GALLONS	AB AQUATICS, INC.
VARIOUS IN SOUTH PART OF ALTON BAY	11/3/11	DASH	6 HOURS, 180 GALLONS	AB AQUATICS, INC.
ISLAND MARINA, MINGE	10-Jul-12	2,4D (G)	2.35	AQUATIC CONTROL

LOCATION	DATE	ACTION	AREA (ac) OR AMOUNT (GAL)	CONTRACTOR
RAND COVE	10-Jul-12	2,4D (G)	2.78	AQUATIC CONTROL
SMALLS COVE	10-Jul-12	2,4D (G)	1.15	AQUATIC CONTROL
SOUTH ALTON BAY	10-Jul-12	2,4D (G)	3.55	AQUATIC CONTROL
ALL INFESTED AREAS	9/10/12-10/6/12	DASH/HAND PULL	30 DAYS, 3,948 GALLONS	AB AQUATICS, INC.
VARIOUS AREAS IN ALTON	6/25/13	RENOVATE MAX G (2,4-D & TRICLOPYR GRANULAR)	7 ACRES	ACT
ROBERTS COVE, ALTON MARINA, RAND COVE, W. ALTON MARINA, WOODMAN COVE, & SOUTH ALTON BAY	10/16 - 10/25/13	DIVER/DASH	420 GALLONS	AB AQUATICS, INC.
DOWNING'S (NORTH, SOUTH, & BY DOCKS)	WEEK ENDING 11/2/13	DIVER/DASH	570 GALLONS	AB AQUATICS, INC.
DOWNING'S DOCKS & RIVER	WEEK ENDING 11/9/13	DIVER/DASH	890 GALLONS	AB AQUATICS, INC.
PORTIONS OF LAKE WINNIPESAUKEE	03-Jun-14	2,4-D BEE	9.7 ACRES	ACT
MIDDLE OF RIVER CHANNEL, SW DOCK S BRIDGE	WEEK 7/21/14-7/25/14	ABA DASH	530 GALLONS	AB AQUATICS, INC.
RIVER CHANNEL, SE OF DICK S OF BRIDGE	25-Jul-14	ABA DASH	110 GALLONS	AB AQUATICS, INC.
MERRYMEETING R SE DOWNINGS DOCK	7/28/14	ABA DASH	30 GALLONS	AB AQUATICS, INC.
MERRYMEETING R 50 YDS SW DOWNINGS	7/29/2014	ABA DASH	60 GALLONS	AB AQUATICS, INC.
MERRYMEETING R 150 YDS SE DOWNINGS	7/30/2014	ABA DASH	200 GALLONS	AB AQUATICS, INC.
MERRYMEETING R 150 YDS SE DOWNINGS	7/31/2014	ABA DASH	180 GALLONS	AB AQUATICS, INC.
MERRYMEETING R 150 YDS SE DOWNINGS	8/1/2014	ABA DASH	140 GALLONS	AB AQUATICS, INC.

LOCATION	DATE	ACTION	AREA (ac) OR AMOUNT (GAL)	CONTRACTOR
MERRYMEETING R. 200 YDS. S OF 11 BRIDGE	8/4/2014	ABA DASH	180 GALLONS	AB AQUATICS, INC.
MERRYMEETING R. 1/4m. S OF 11 BRIDGE	8/6/2014	ABA DASH	240 GALLONS	AB AQUATICS, INC.
50 DOWNSTREAM OF 3RD BRIDGE	8/6/2014	ABA DASH	120 GALLONS	AB AQUATICS, INC.
MERRYMEETING R 1/4m. S OF 11 BRIDGE	8/7/14	ABA DASH	320 GALLONS	AB AQUATICS, INC.
BEND DOWNSTREAM OF 3RD BRIDGE	8/7/14	ABA DASH	140 GALLONS	AB AQUATICS, INC.
MERRYMEETING R. 1/4m. S OF 11 BRIDGE	8/8/14	ABA DASH	240 GALLONS	AB AQUATICS, INC.
BEND DOWNSTREAM OF 3RD BRIDGE	8/8/14	ABA DASH	90 GALLONS	AB AQUATICS, INC.
RAND COVE	9/16/14	ABA DASH	20	AB AQUATICS, INC.
RAND COVE	9/18/14	ABA DASH	120	AB AQUATICS, INC.
RAND COVE	9/19/14	ABA DASH	60	AB AQUATICS, INC.
RAND COVE	9/20/14	ABA DASH	160	AB AQUATICS, INC.
DOWNINGS LANDING DOCKS	9/23/14	ABA DASH	2 GALLONS	AB AQUATICS, INC.
TOWN BEACH	9/23/14	ABA DASH	18 GALLONS	AB AQUATICS, INC.
MMR 3RD BRIDGE NEXT TO PARK	9/23/14	DASH/HAND PULL	100 GALLONS	AB AQUATICS, INC.
MMR 3RD BRIDGE NEXT TO PARK	9/24/14	DASH/HAND PULL	200 GALLONS	AB AQUATICS, INC.
MMR 3RD BRIDGE NEXT TO PARK	9/25/14	DASH/HAND PULL	160 GALLONS	AB AQUATICS, INC.
MMR 3RD BRIDGE NEXT TO PARK	9/26/14	DASH/HAND PULL	160 GALLONS	AB AQUATICS, INC.
MINGE COVE/ASSOCIATION DOCKS	10/4/14	HAND PULL	20 GALLONS	AB AQUATICS, INC.
Parker Marina and Area H	6/29/15	2,4-D BEE	4.2 ACRES	ACT
MINGE COVE/WESTERN COVE	7/27/15	ABA DASH	90 GALLONS	AB AQUATICS, INC.
MT WASHINGTON PIER	7/28/15	ABA DASH	25 GALLONS	AB AQUATICS, INC.
MT WASHINGTON PIER/CENTER OF BAY	7/29/15	ABA DASH	55 GALLONS	AB AQUATICS, INC.

LOCATION	DATE	ACTION	AREA (ac) OR AMOUNT (GAL)	CONTRACTOR
MMR ZONE 2	7/30/15	ABA DASH	170 GALLONS	AB AQUATICS, INC.
MMR ZONE 2	7/31/15	ABA DASH	260 GALLONS	AB AQUATICS, INC.
Zone 2	8/1/15	ABA DASH	313.2 GALLONS	AB AQUATICS, INC.
Zone 2	8/2/15	ABA DASH	240 GALLONS	AB AQUATICS, INC.
Zone 2, 3	8/10/15	ABA DASH	260 GALLONS	AB AQUATICS, INC.
Zone 3	8/11/15	ABA DASH	360 GALLONS	AB AQUATICS, INC.
Zone 3	8/12/15	ABA DASH	200 GALLONS	AB AQUATICS, INC.
Zone 3, 4	8/13/15	ABA DASH	300 GALLONS	AB AQUATICS, INC.
Zone 3, 4	8/14/15	ABA DASH	180 GALLONS	AB AQUATICS, INC.
Zone 2, 3, 4	8/17/15	ABA DASH	280 GALLONS	AB AQUATICS, INC.
Zone 2	8/18/15	ABA DASH	200 GALLONS	AB AQUATICS, INC.
North of Dam MMR	8/19/15	ABA DASH	620 GALLONS	AB AQUATICS, INC.
Dam of MMR	8/20/15	ABA DASH	440 GALLONS	AB AQUATICS, INC.
Zone 2, 3	8/21/15	ABA DASH	240 GALLONS	AB AQUATICS, INC.

Feasibility Evaluation of Control Options in this Waterbody

DES has evaluated the feasibility of potential control practices on Alton Bay Area, Lake Winnipesaukee. The following table summarizes DES' control strategy recommendations for Alton Bay Area, Lake Winnipesaukee

Control Method	Use on Alton Bay Area, Lake Winnipesaukee
Restricted Use Areas (RUAs) and/or Fragment Barriers	RUAs and fragment barriers can feasibly be used in many places where isolated infestations occur in this large area of the lake. Where small coves or embayments have infestations adjacent to large uninfested areas, RUAs or fragment barriers will be considered as management activities progress.
Hand-pulling and Diver-Assisted	Hand pulling and diver assisted suction harvesting are recommended for this waterbody in any areas

Control Method	Use on Alton Bay Area, Lake Winnipesaukee
Suction Harvesting	where variable milfoil is sparse enough for the method(s) to be effective. Either or both method should be employed following herbicide treatments as well, and a diver/DASH service provider held on retainer is recommended, so as to have a regular team in place for milfoil control efforts during the growing season.
Mechanical Harvesting/Removal	Not recommended due to risk of fragmentation and further spread.
Benthic Barriers	Benthic barriers are recommended in beach areas or areas where persistent growth is present and barriers are appropriate for use.
Herbicides	Herbicide treatment is recommended when non-chemical means of control cannot feasibly be used.
Extended Drawdown	Not feasible in this basin for a variety of reasons, including size, shoreline configuration, recreational uses and others.
Dredge	Cost prohibitive and disruptive to many organisms.
Biological Control	No approved biological controls are available for variable milfoil
No Control	A no control option is not recommended. Variable milfoil growth around this portion of Lake Winnipesaukee is present around marinas and docks and public access sites, not to mention swim areas. The milfoil is being fragmented by recreational uses of the waterbody and as such continues to spread.

Recommended Actions, Timeframes and Responsible Parties

Year	Action	Responsible Party	Schedule
2012	Spring survey and determination of areas for various control techniques.	DES	June/ August
	Weed Watching and reporting of infestations	Local Weed Watchers and volunteers	May through September

Year	Action	Responsible Party	Schedule
	Herbicide treatment, if needed. *Note that the map in Figure 1 illustrates areas of milfoil growth, not necessarily areas for treatment. A final treatment map will be prepared in 2012 based on field visits prior to treatment. Maps will be shared with interested parties.*	Aquatic Control Technology, Inc.	June or September
	Diver hand removal and/or DASH	Contract Diver	As needed May through October
	End of season survey and planning for next year	DES	September/ October
2013	Spring and late summer survey and determination of areas for various control techniques.	DES	June/ August
	Weed Watching and reporting of infestations	Local Weed Watchers and volunteers	May through September
	Herbicide treatment, if needed	Aquatic Control Technology	June or September
	Diver hand removal and/or DASH	Contract Diver	As needed May through October
	End of season survey and planning for next year	DES	September/ October
2014	Spring and late summer survey and determination of areas for various control techniques.	DES	June/ August
	Weed Watching and reporting of infestations	Local Weed Watchers and volunteers	May through September
	Diver hand removal and/or DASH	Contract Diver	As needed May through October

Year	Action	Responsible Party	Schedule
	Herbicide treatment (see Figure 2 map for proposed/potential 2014 herbicide treatment areas)	Aquatic Control Technology	Late June/early July or early September
	End of season survey and planning for next year	DES	September/ October
2015	Spring and late summer survey and determination of areas for various control techniques.	DES	June/ August
	Weed Watching and reporting of infestations	Local Weed Watchers and volunteers	May through September
	Diver hand removal and/or DASH	Contract Diver	As needed May through October
	Herbicide treatment (see Figure 2 map for standing proposed/potential herbicide treatment areas)	Aquatic Control Technology	Late June or early September
	End of season survey and planning for next year	DES	September/ October
2016	Spring and late summer survey and determination of areas for various control techniques.	DES	June/ August
	Weed Watching and reporting of infestations	Local Weed Watchers and volunteers	May through September
	Diver hand removal and/or DASH	Contract Diver	As needed May through October
	Herbicide treatment (see Figure 2 map for standing proposed/potential herbicide treatment areas)	SŌLitude Lake Management, LLC	Late June or early September
	End of season survey and planning for next year	DES	September/ October
2017	Update Long-Term Management Plan	DES and interested parties	Fall/Winter

Notes

Target Specificity

It is important to realize that aquatic herbicide applications are conducted in a specific and scientific manner. To the extent feasible, the permitting authority favors the use of selective herbicides that, where used appropriately, will control the target plant with little or no impact to non-target species, such that the ecological functions of native plants for habitat, lake ecology, and chemistry/biology will be maintained. *Not all aquatic plants will be impacted as a result of an herbicide treatment.*

Adaptive Management

Because this is a natural system that is being evaluated for management, it is impossible to accurately predict a management course over five years that could be heavily dependent on uncontrolled natural circumstances (weather patterns, temperature, adaptability of invasive species, etc).

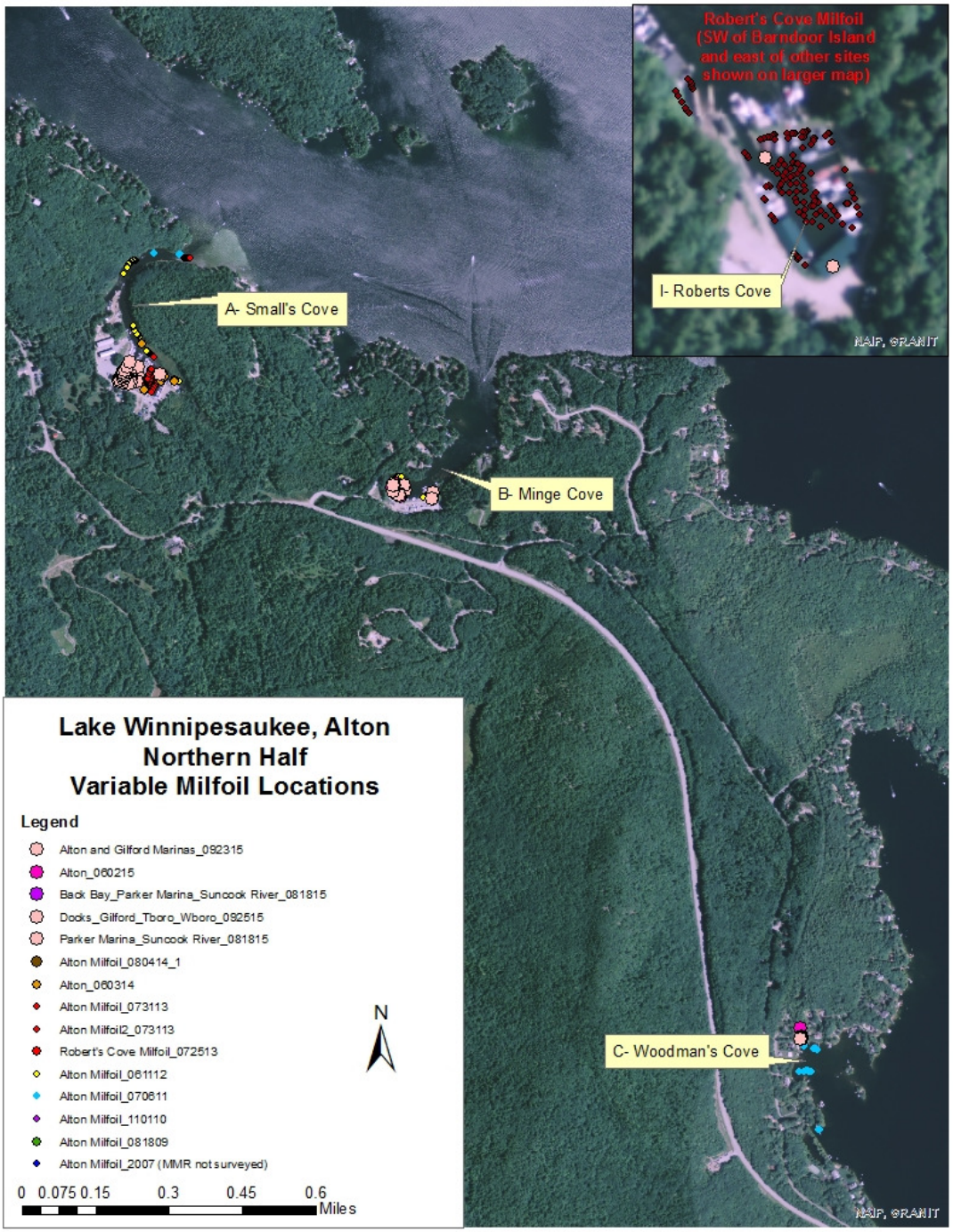
This long-term plan is therefore based on the concept of adaptive management, where current field data drive decision making, which may result in modifications to the recommended control actions and timeframes for control. As such, this management plan should be considered a dynamic document that is geared to the actual field conditions that present themselves in this waterbody.

If circumstances arise that require the modification of part or all of the recommendations herein, interested parties will be consulted for their input on revisions that may be needed to further the goal of variable milfoil management in the subject waterbody.

Therefore, the approach for Alton is to perform regular surveys to track the variable milfoil growth and to guide management activities based on real-time condition in the system. Diving will be done when feasible, and herbicides will only be used if densities or distribution of milfoil preclude successful dive activity.

Figure 1: Variable Milfoil Infestation Over Time

North End



South End

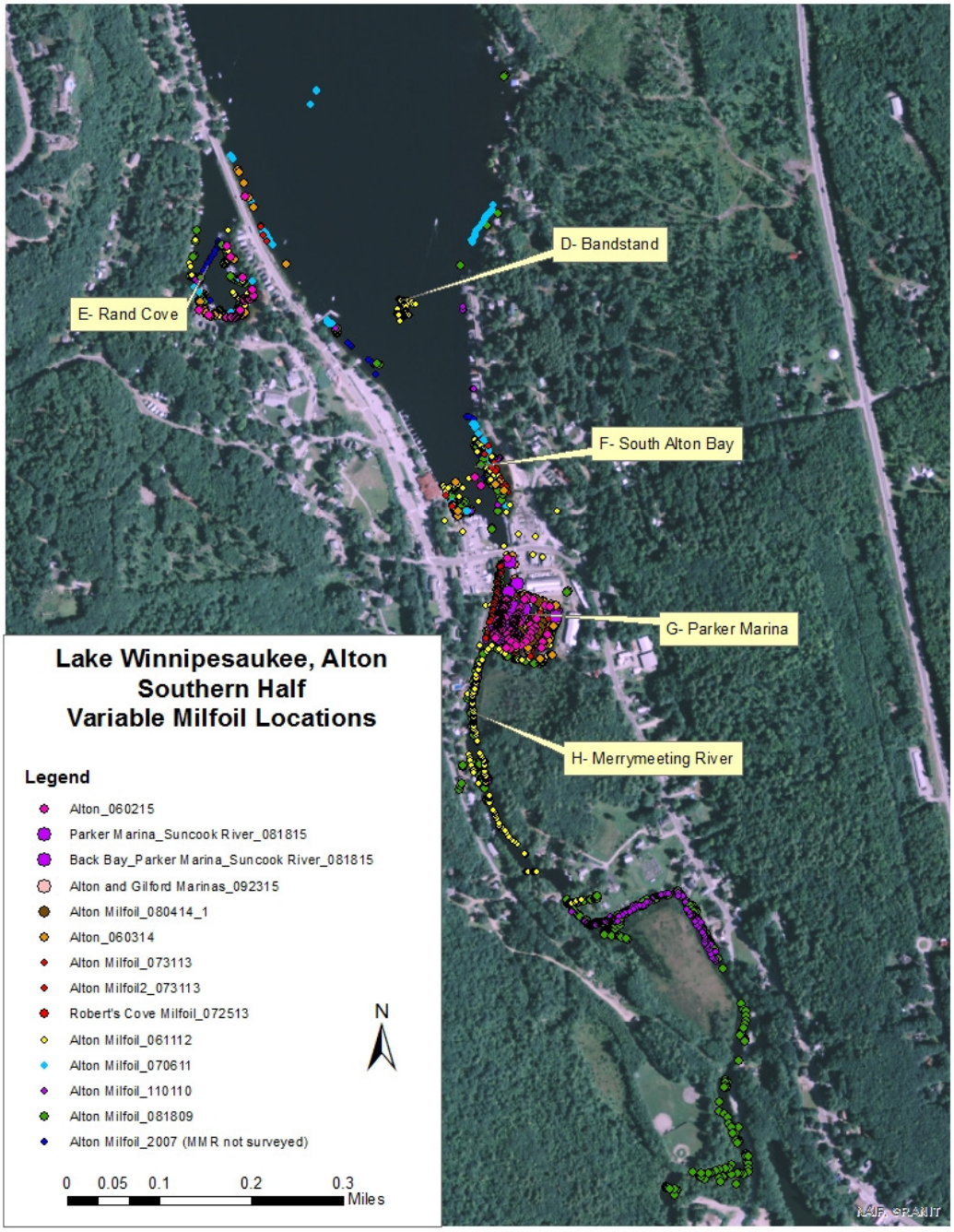
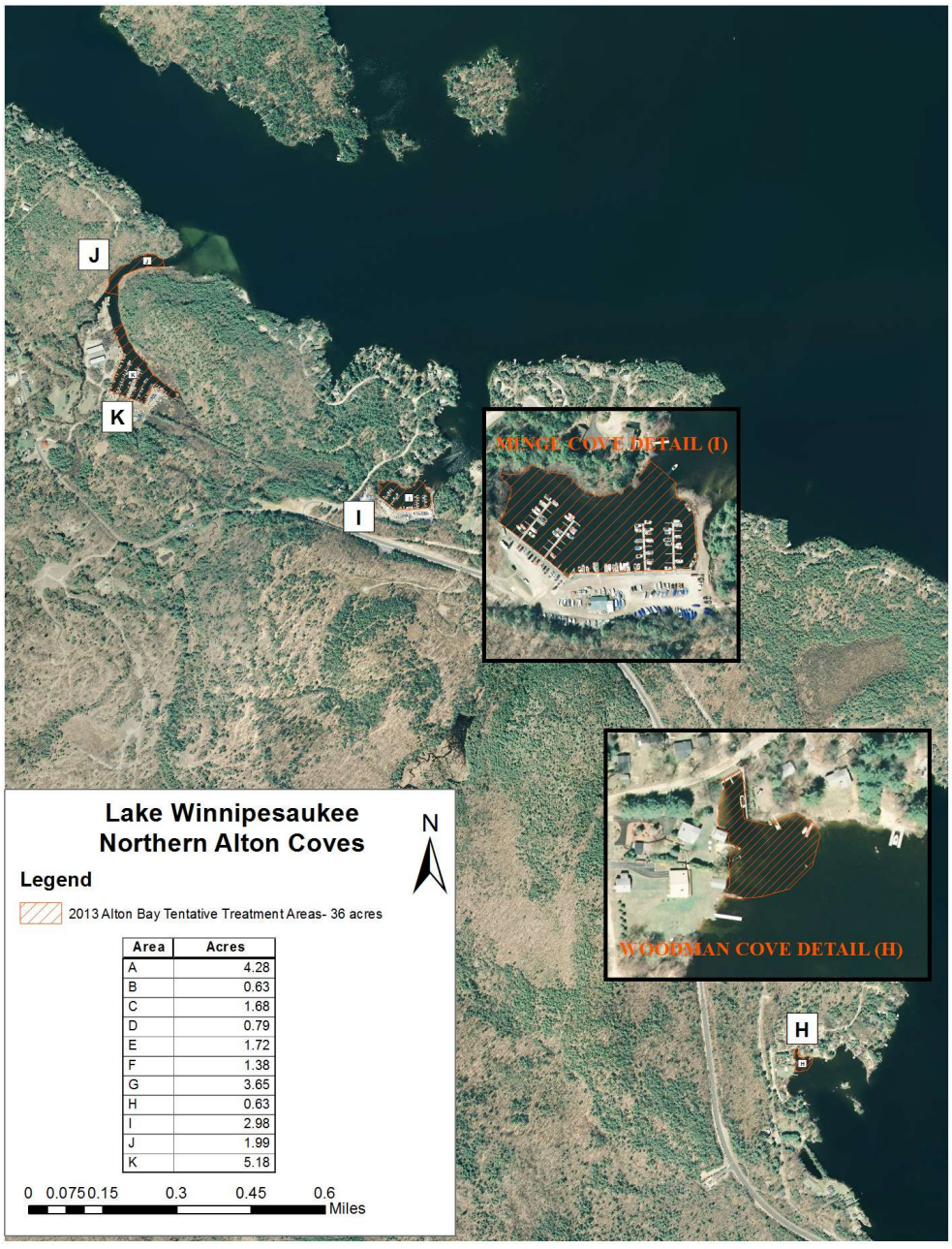
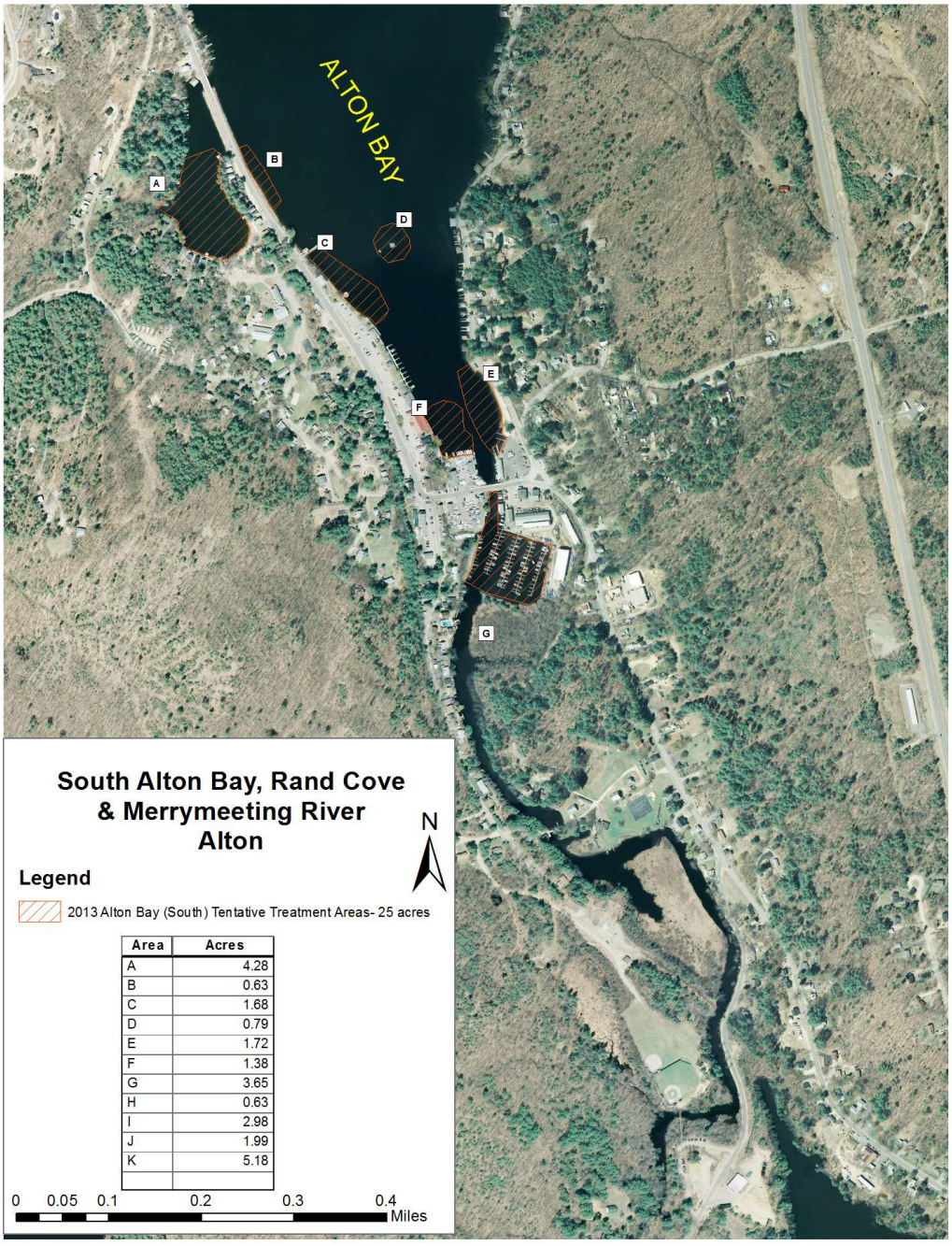

D- Bandstand
E- Rand Cove
F- South Alton Bay
G- Parker Marina
H- Merrymeeting River
Lake Winnipesaukee, Alton
Southern Half
Variable Milfoil Locations
Legend
Alton_060215
Parker Marina_Suncook River_081815
Back Bay_Parker Marina_Suncook River_081815
Alton and Gilford Marinas_092315
Alton Milfoil_080414_1
Alton_060314
Alton Milfoil_073113
Alton Milfoil2_073113
Robert's Cove Milfoil_072513
Alton Milfoil_061112
Alton Milfoil_070611
Alton Milfoil_110110
Alton Milfoil_081809
Alton Milfoil_2007 (MMR not surveyed)
N
0 0.05 0.1 0.2 0.3
Miles
NAIP, GRANIT

Figure 2: Variable Milfoil Control Actions

Standard proposed treatment areas- only as needed

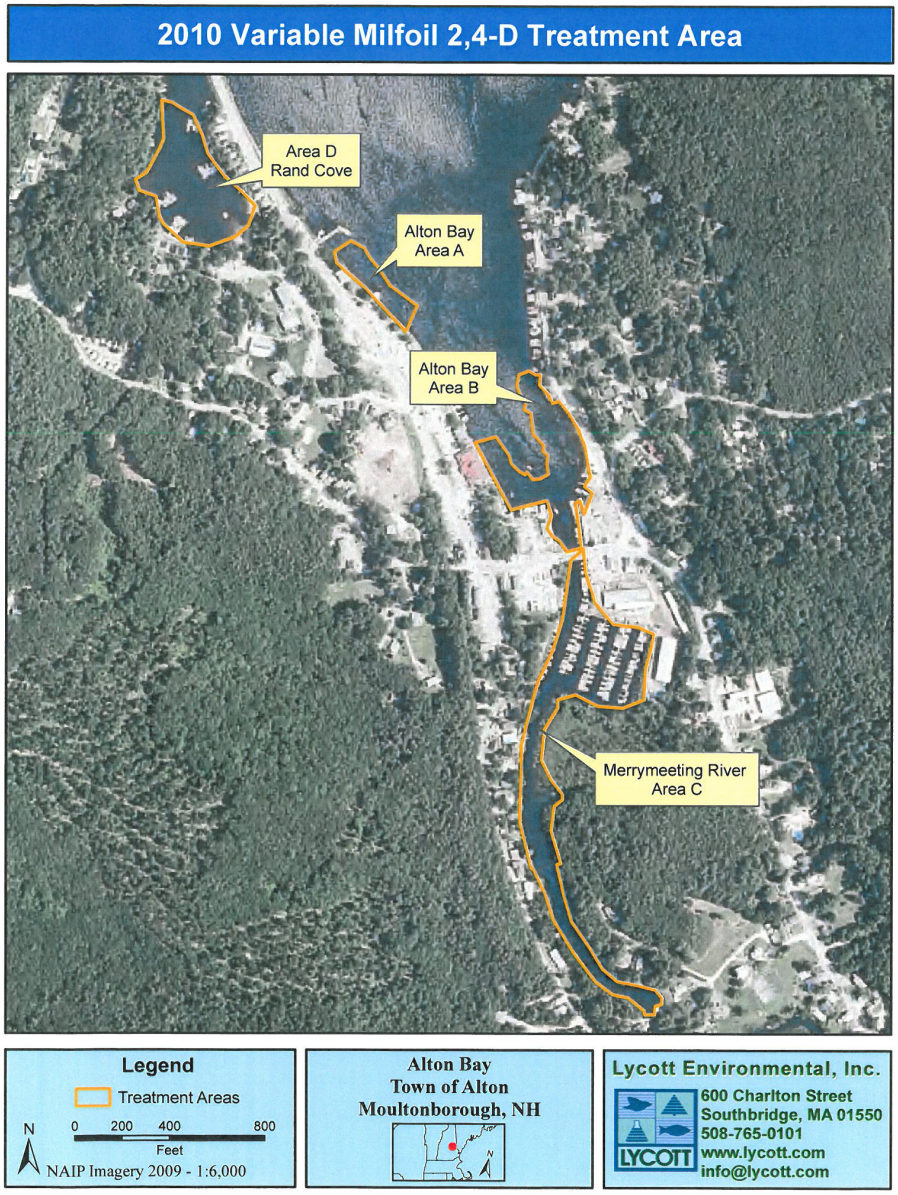


Area	Acres
A	4.28
B	0.63
C	1.68
D	0.79
E	1.72
F	1.38
G	3.65
H	0.63
I	2.98
J	1.99
K	5.18

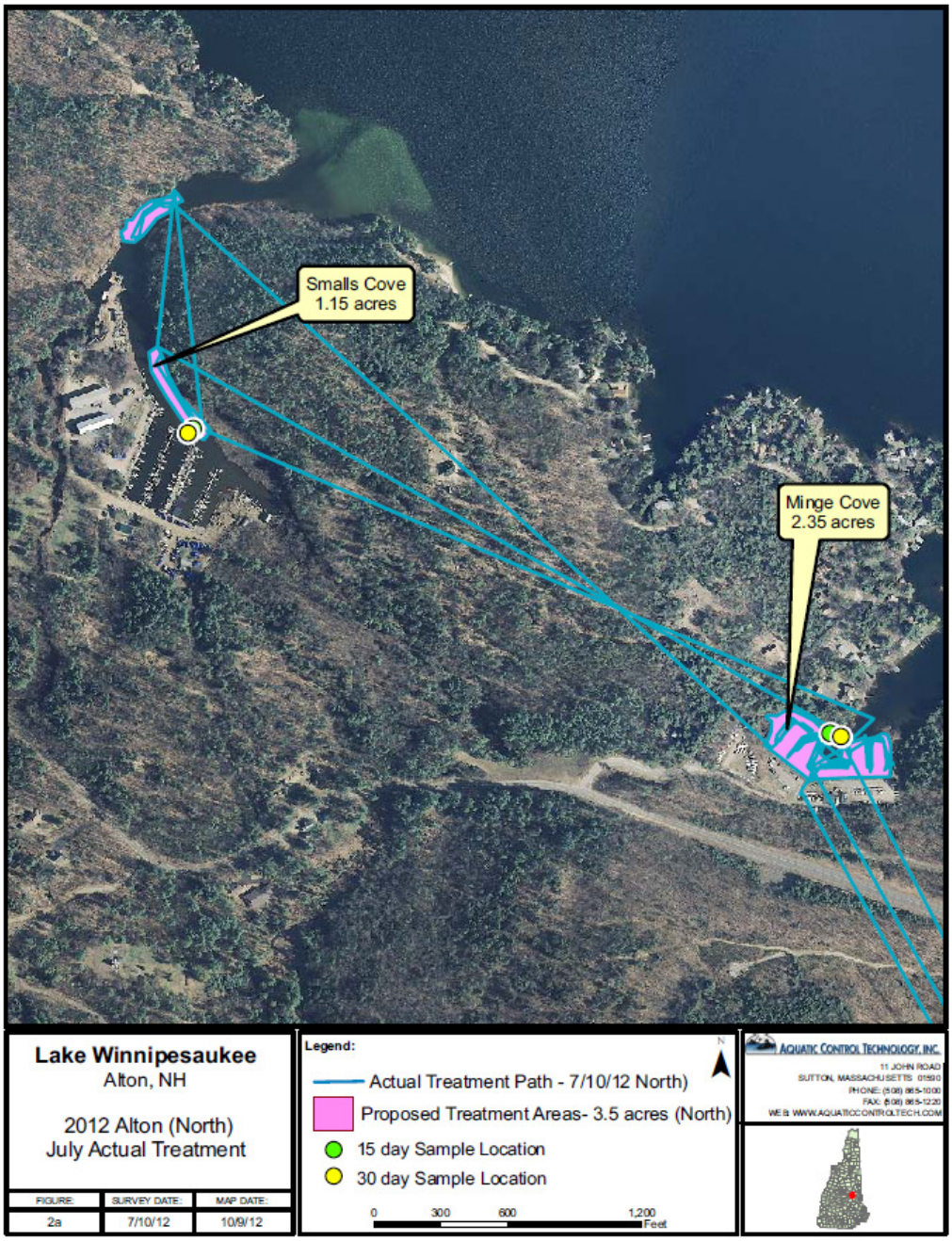


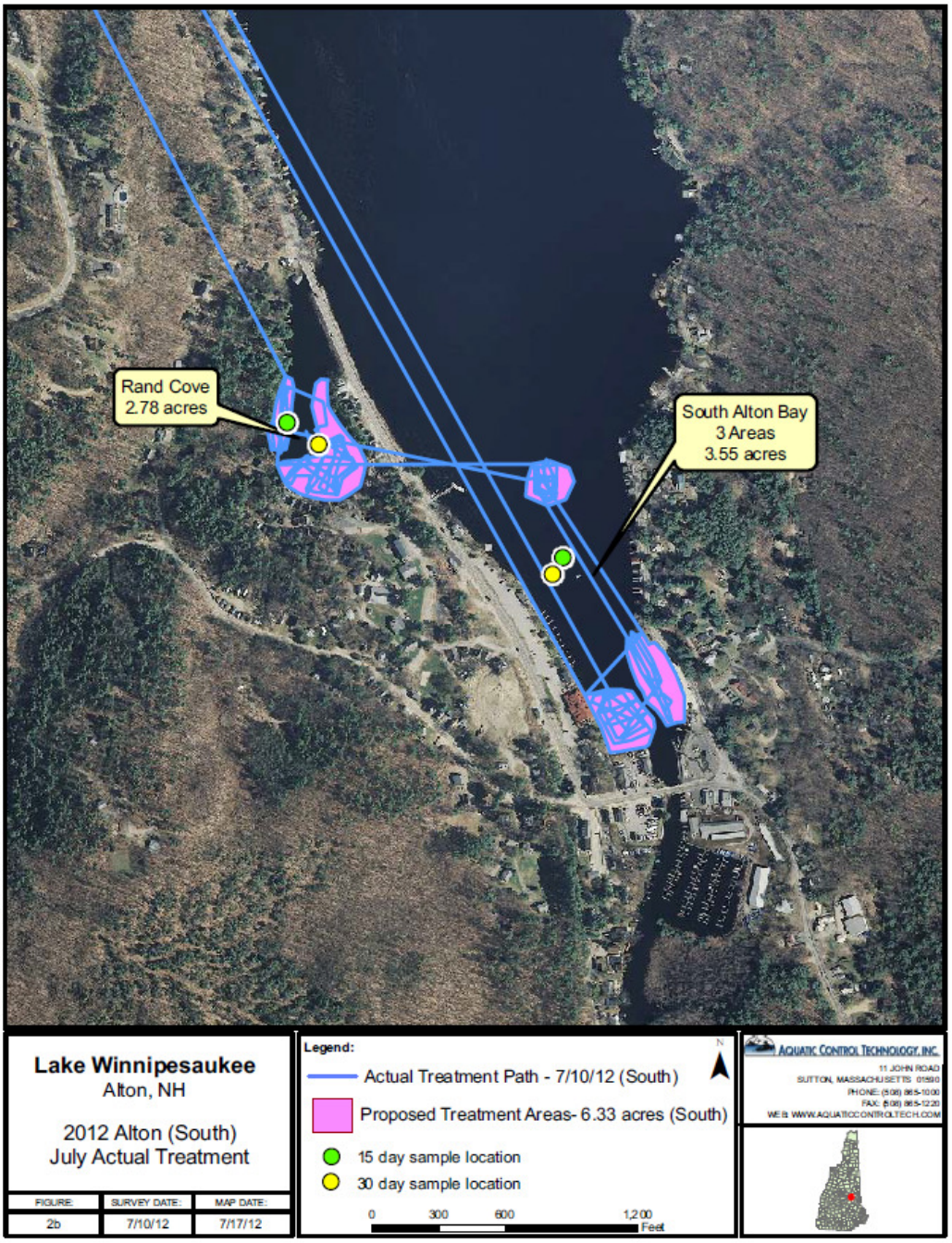
Area	Acres
A	4.28
B	0.63
C	1.68
D	0.79
E	1.72
F	1.38
G	3.65
H	0.63
I	2.98
J	1.99
K	5.18

2010 (map produced by Lycott Environmental)

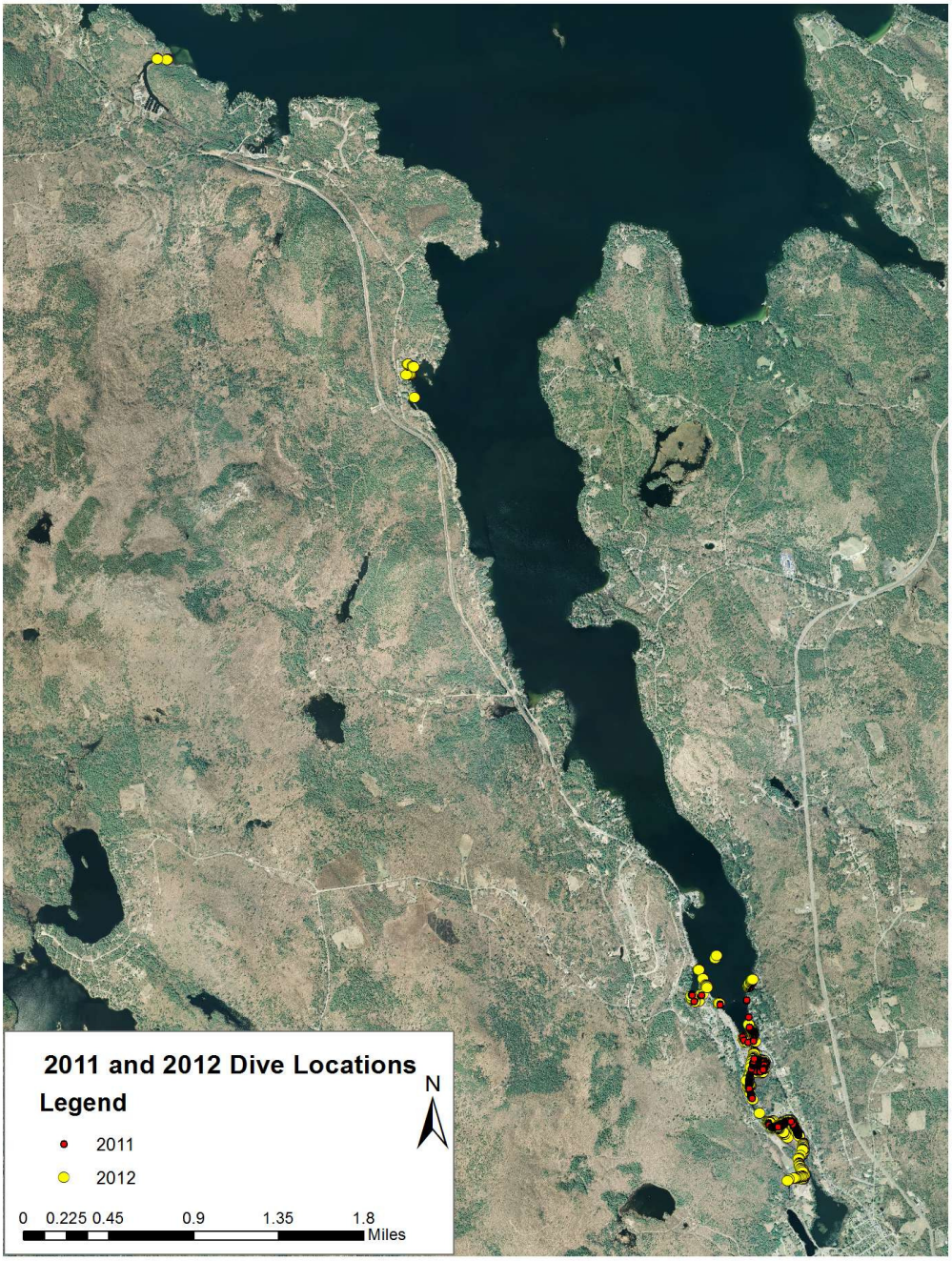


2012 (2 maps produced by Aquatic Control Technology)

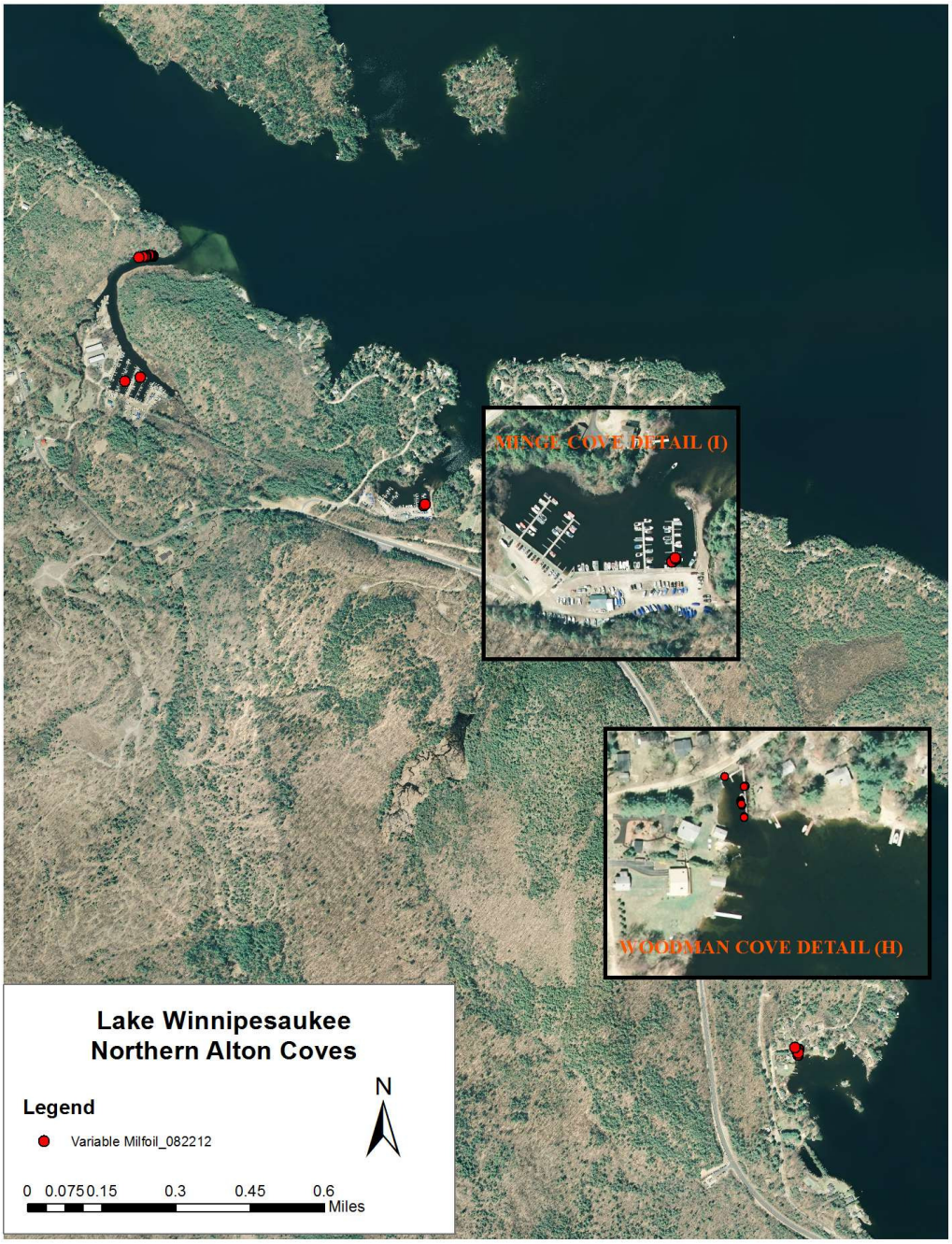



Rand Cove
2.78 acres
South Alton Bay
3 Areas
3.55 acres
Lake Winnipesaukee
Alton, NH
2012 Alton (South)
July Actual Treatment
FIGURE:
2b
SURVEY DATE:
7/10/12
MAP DATE:
7/17/12
Legend:
Actual Treatment Path - 7/10/12 (South)
Proposed Treatment Areas- 6.33 acres (South)
15 day sample location
30 day sample location
0
300
600
1,200
Feet
AQUATIC CONTROL TECHNOLOGY, INC.
11 JOHN ROAD
SUTTON, MASSACHUSETTS 01590
PHONE: (508) 865-1000
FAX: (508) 865-1220
WEB: WWW.AQUATICCONTROLTECH.COM

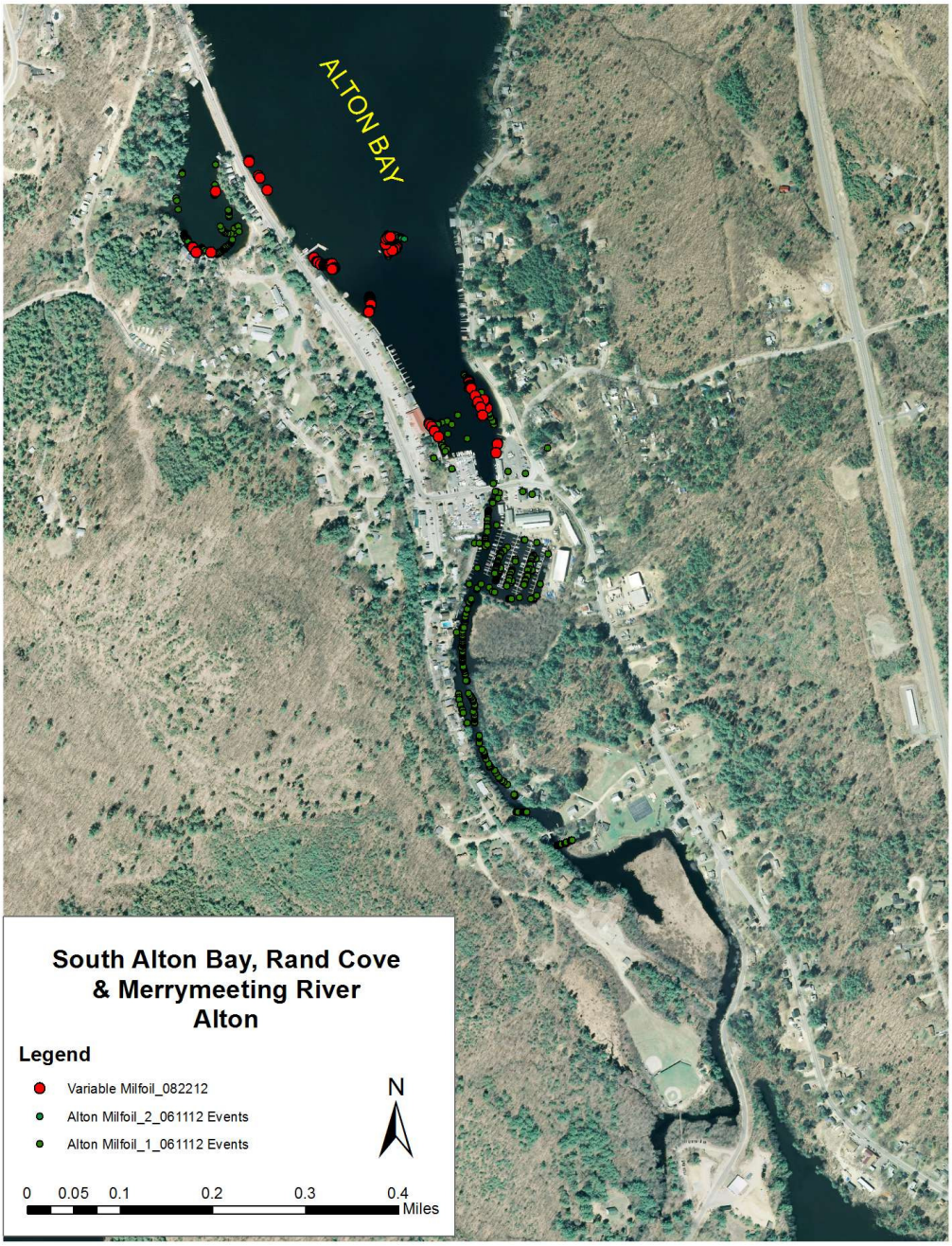
2011 and 2012 Diving Locations



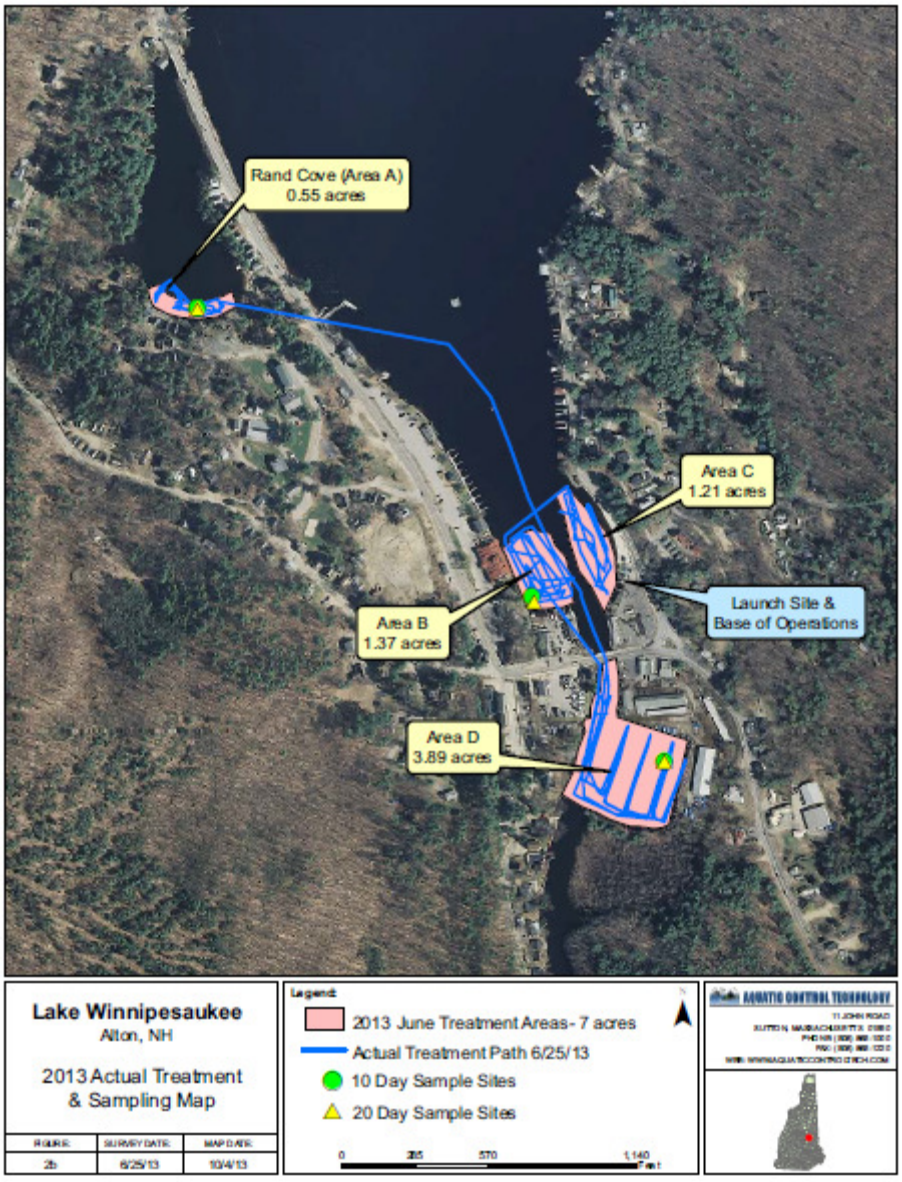
2013 (proposed dive areas- 2 maps)



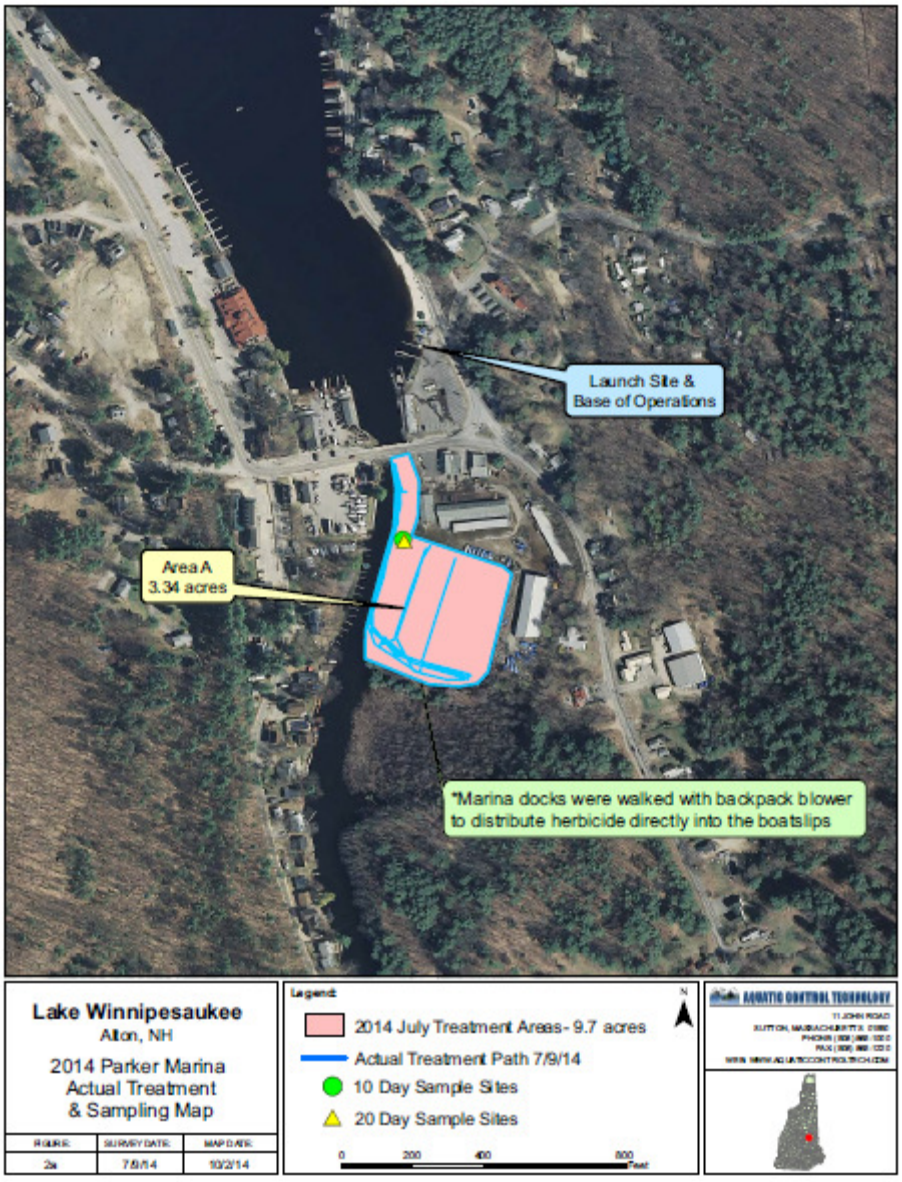
2013 (proposed dive areas)

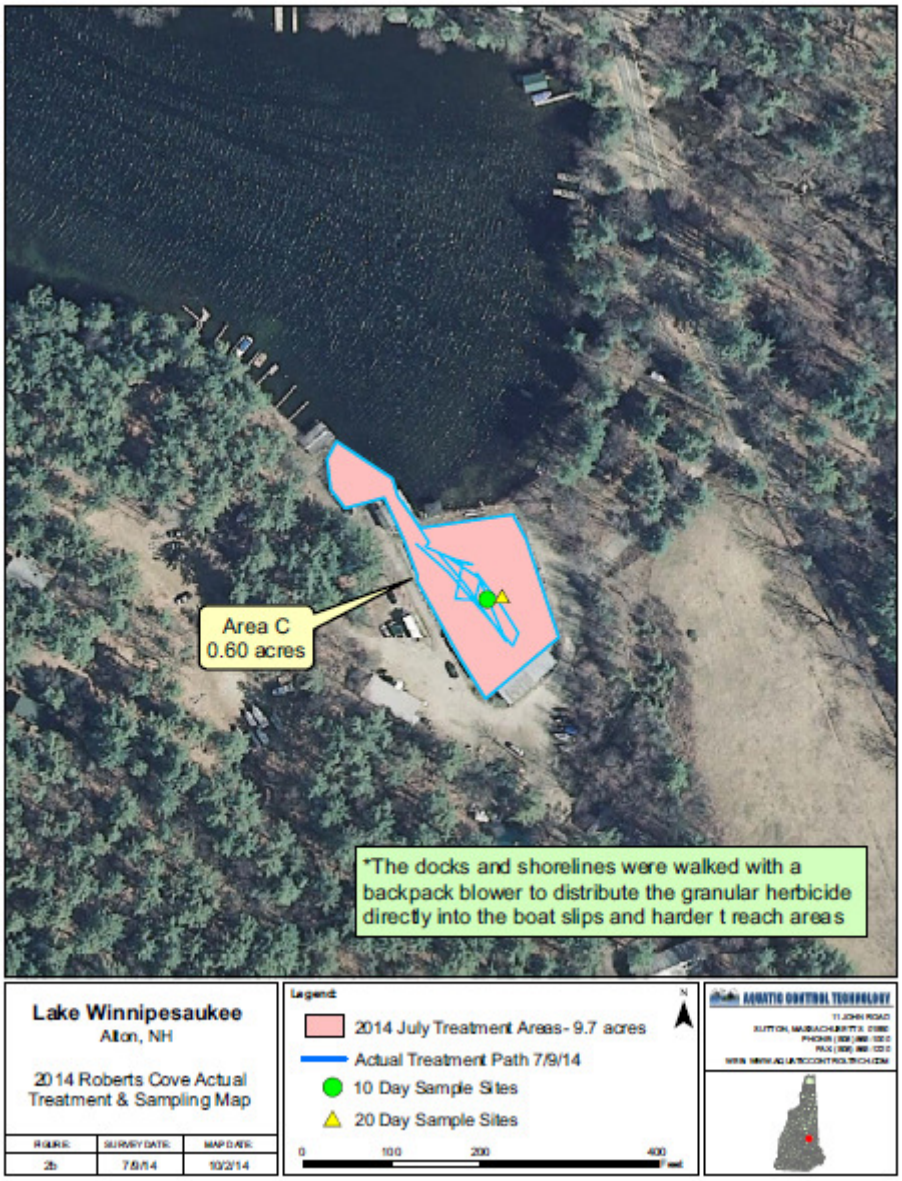


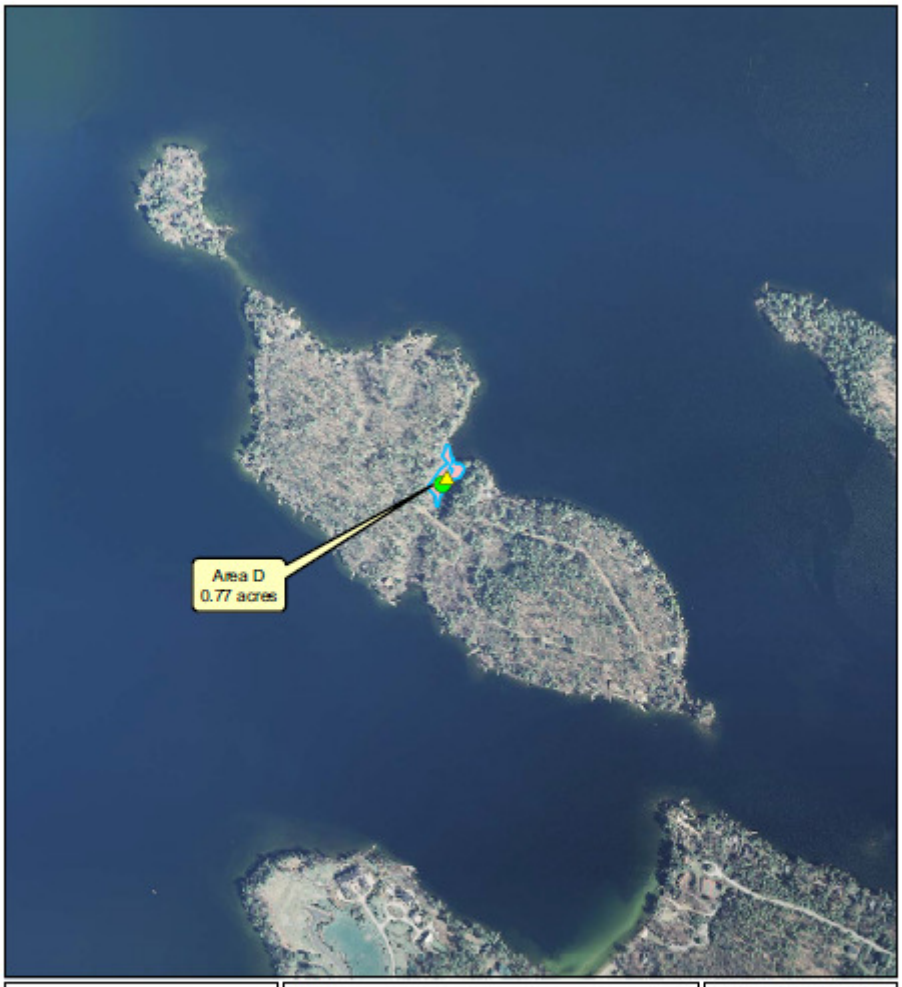
2013 (actual treatment areas, map provided by ACT)



2014 (actual treatment areas (4 maps), maps provided by ACT)




Area C
0.60 acres
*The docks and shorelines were walked with a backpack blower to distribute the granular herbicide directly into the boat slips and harder t reach areas
Lake Winnipesaukee
Alton, NH
2014 Roberts Cove Actual Treatment & Sampling Map
FIGURE
SURVEY DATE
MAP DATE
2b
7/9/14
10/2/14
Legend:
2014 July Treatment Areas- 9.7 acres
Actual Treatment Path 7/9/14
10 Day Sample Sites
20 Day Sample Sites
N
0
100
200
400
feet
AQUATIC CONTROL TECHNOLOGY



Lake Winnipesaukee
Alton, NH

2014 Barndoor Island Actual Treatment & Sampling Map

FIGURE:	SURVEY DATE:	MAP DATE:
2c	7/9/14	10/2/14

Legend:

- 2014 July Treatment Areas- 9.7 acres
- Actual Treatment Path 7/9/14
- 10 Day Sample Sites
- 20 Day Sample Sites

N

0 450 900 1,800 Feet

AQUATIC CONTROL TECHNOLOGY

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Area B
4.93 acres
Lake Winnipesaukee
Alton, NH
2014 West Alton Marina
Actual Treatment
& Sampling Map
FIGURE
SURVEY DATE
MAP DATE
2d
7/9/14
10/2/14
Legend:
2014 July Treatment Areas- 9.7 acres
Actual Treatment Path 7/9/14
10 Day Sample Sites
20 Day Sample Sites
N
0
250
500
1,000
Feet
AQUATIC CONTROL TECHNOLOGY

2015 (actual treatment areas, map provided by ACT)

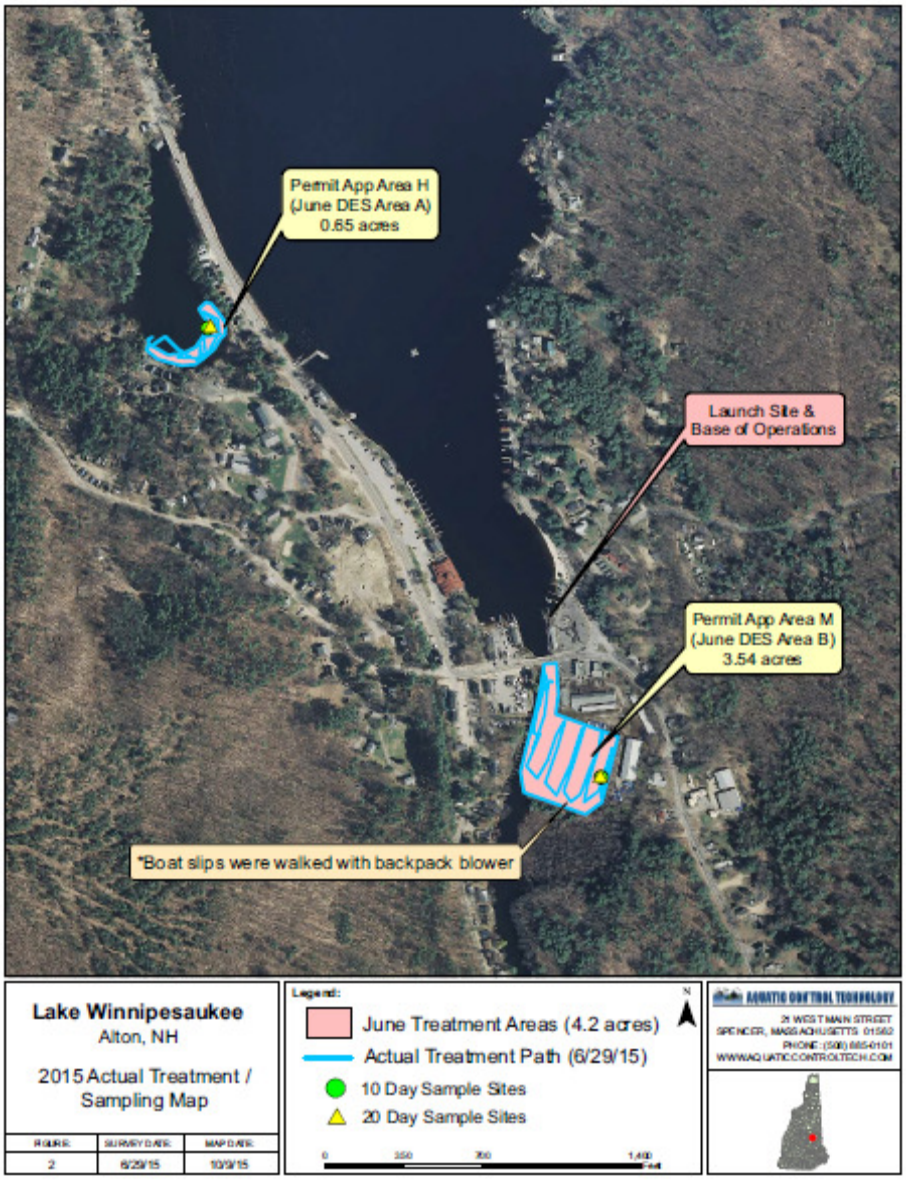


Figure 3: Map of Native Aquatic Macrophytes

Symbol	Common Name	Latin Name
V	Tapegrass	*Vallisneria*
S	Bur-reed	*Sparganium*
B	Watershield	*Brasenia*
A	Bassweed	*Potamogeton amplifolius*
R	Robbin's pondweed	*Potamogeton robbinsii*
U	Bladderwort	*Utricularia*
P	Pondweed spp	*Potamogeton spp.*
Q	Quillwort	*Isoetes*
M	**Variable milfoil**	***Myriophyllum heterophyllum***

Figure 4: Bathymetric Map

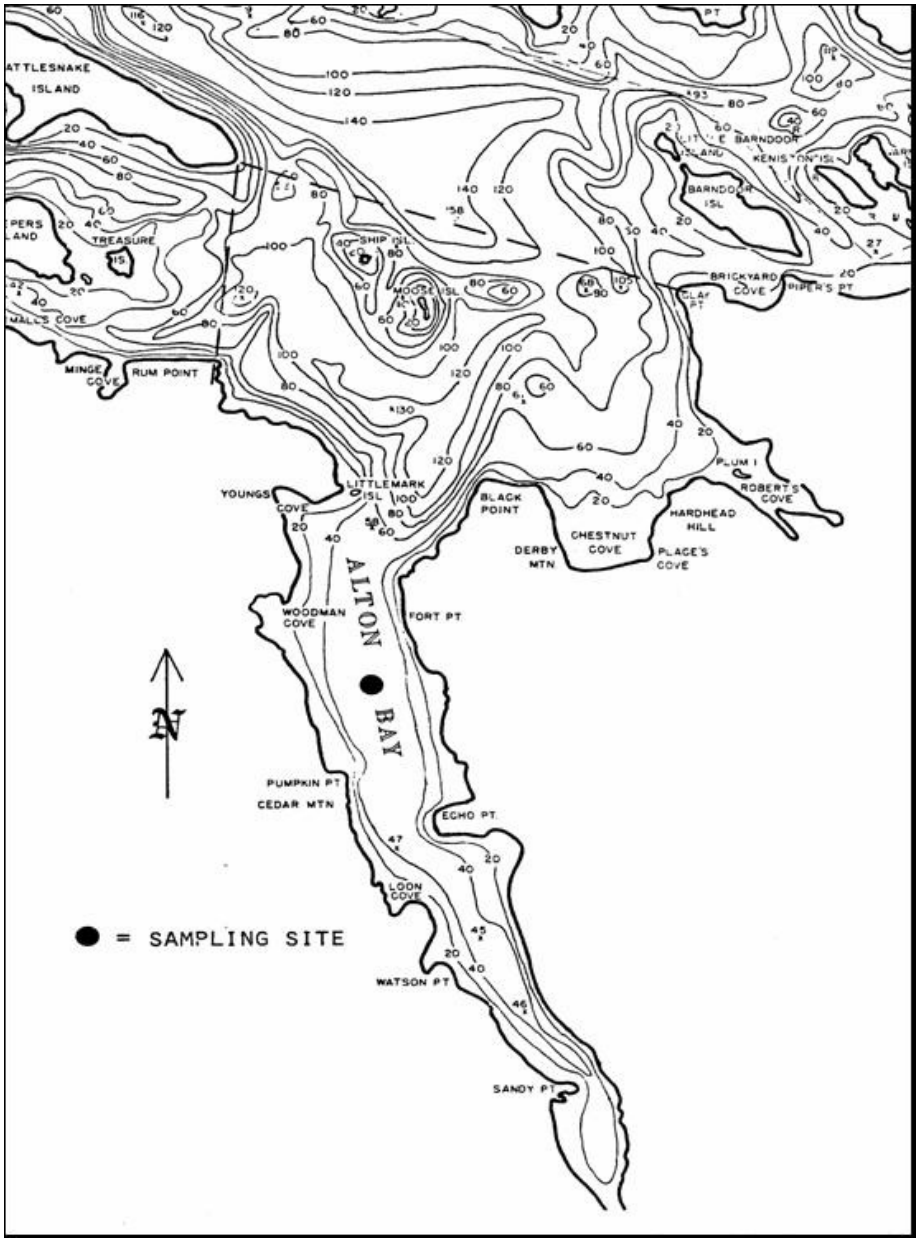


Figure 5: Critical Habitats or Conservation Areas

NHB15-1099

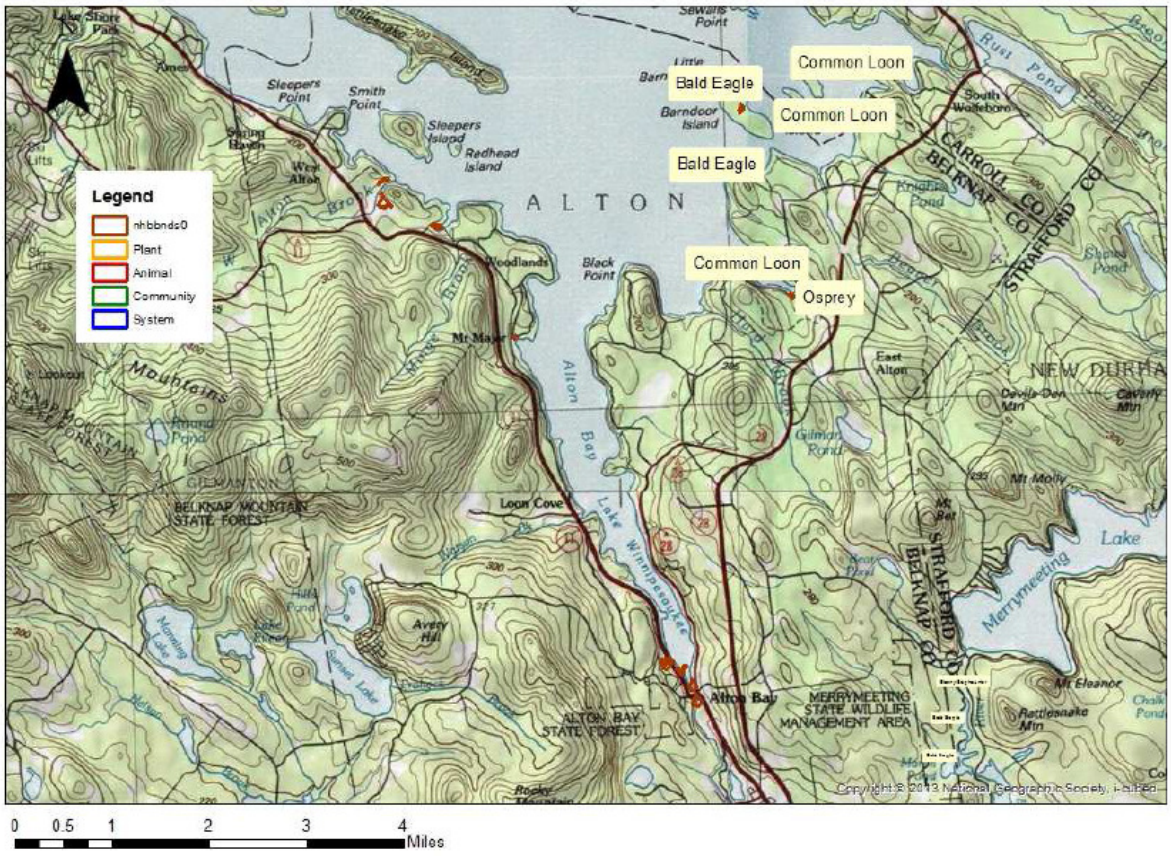


Figure 6: Public Access Sites, Swim Areas

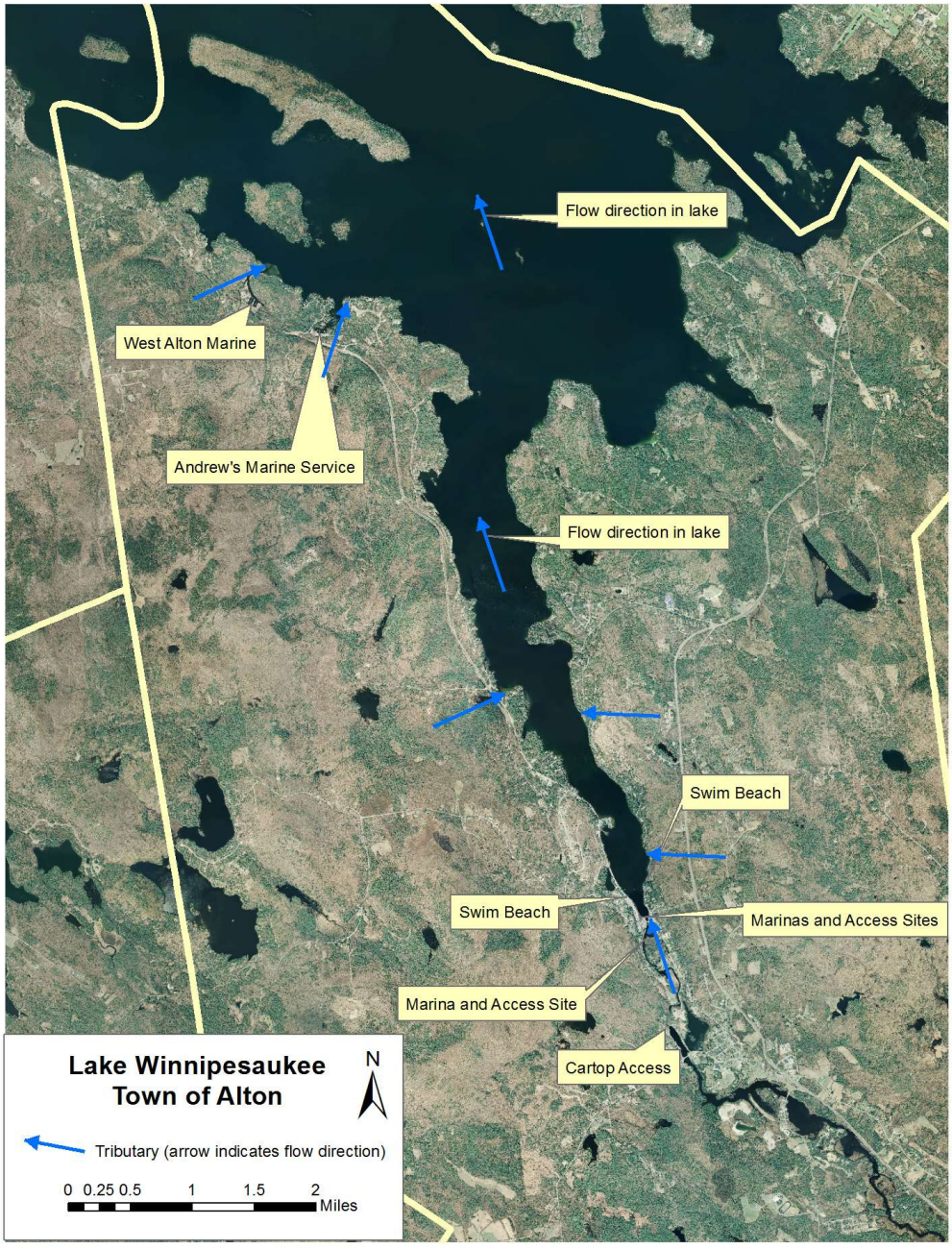
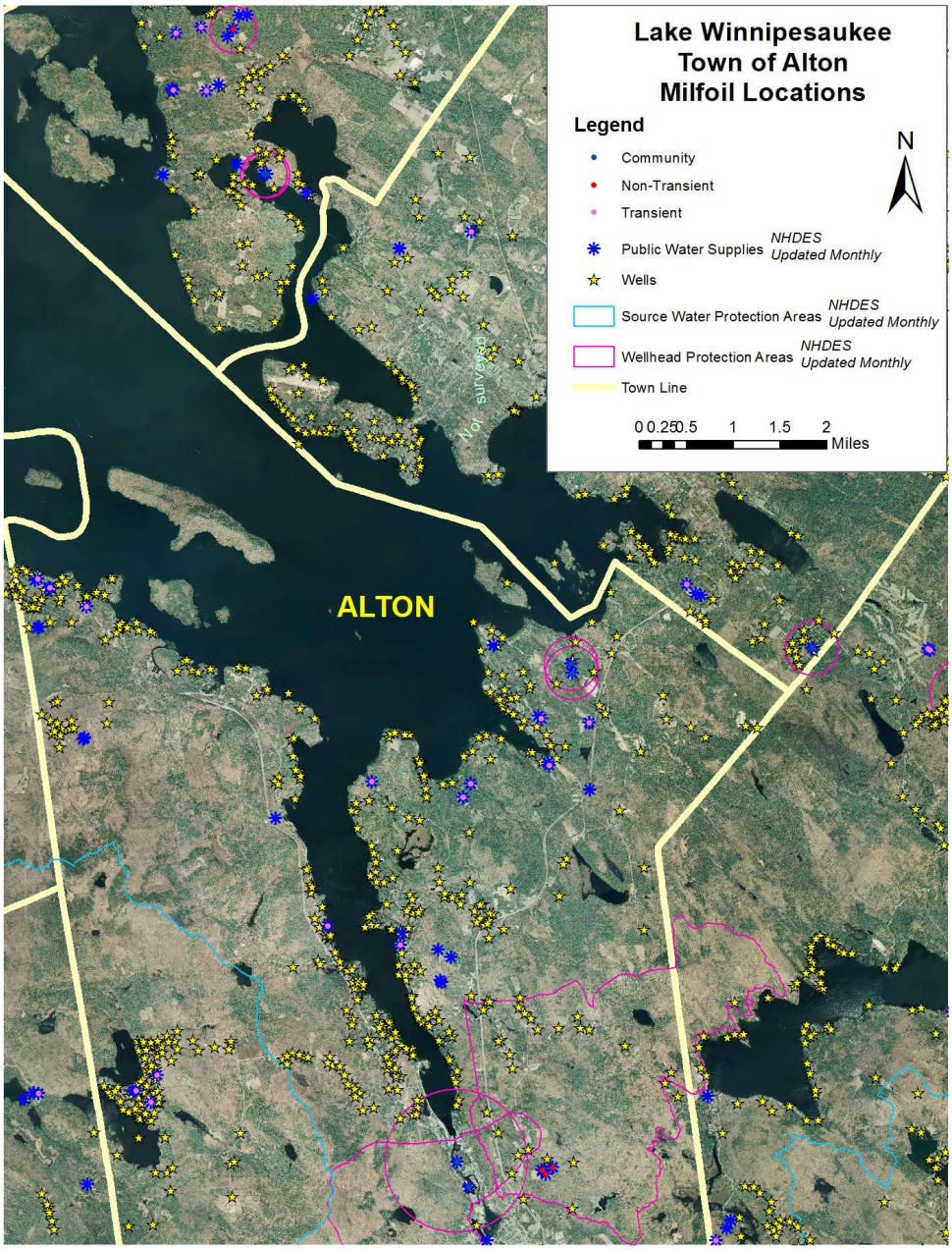


Figure 7: Wells and Water Supplies



Appendix A Selection of Aquatic Plant Control Techniques

Preliminary Investigations

I. Field Site Inspection

- Verify genus and species of the plant.
- Determine if the plant is a native or exotic species per RSA 487:16, II.
- Map extent of the plant infestation (area, water depth, height of the plant, density of the population).
- Document any native plant abundances and community structure around and dispersed within the exotic/nuisance plant population.

II. Office/Laboratory Research of Waterbody Characteristics

- Contact the appropriate agencies to determine the presence of rare or endangered species in the waterbody or its prime wetlands.
- Determine the basic relevant limnological characteristics of the waterbody (size, bathymetry, flushing rate, nutrient levels, trophic status, and type and extent of adjacent wetlands).
- Determine the potential impacts to downstream waterbodies based on limnological characteristics (water chemistry, quantity, quality).

Overall Control Options

For any given waterbody that has an infestation of exotic plants, one of four options will be selected, based on the status of the infestation, the available management options, and the technical knowledge of the DES Limnologists who have conducted the field work and who are preparing this plan. The options are as follows:

1) Eradication: The goal is to completely remove the exotic plant infestation over time. In some situations this may be a rapid response that results in an eradication event in a single season (such as for a new infestation), in other situations a longer-term approach may be warranted given the age and distribution of the infestation. Eradication is more feasible in smaller systems without extensive expanded growth (for example, Lake Winnipesaukee is unlikely to achieve eradication of its variable milfoil), or without upstream sources of infestation in other connected systems that continually feed the lake.

2) Maintenance: Waterbodies where maintenance is specified as a goal are generally those with expansive infestations, that are larger systems, that have complications of extensive wetland complexes on their periphery, or that have upstream sources of the invasive plant precluding the possibility for eradication. For waterbodies where maintenance is the goal, control activities will be performed on the waterbody to keep an infestation below a desirable threshold. For maintenance projects, thresholds of percent cover or other

measurable classification will be indicated, and action will occur when exotic plant growth exceeds the threshold.

3) Containment: The aim of this approach is to limit the size and extent of the existing infestation within an infested waterbody if it is localized in one portion of that waterbody (such as in a cove or embayment), or if a whole lake is infested action may be taken to prevent the downstream migration of fragments or propagules. This could be achieved through the use of fragment barriers and/or Restricted Use Areas or other such physical means of containment. Other control activities may also be used to reduce the infestation within the containment area.

4) No action. If the infestation is too large, spreading too quickly, and past management strategies have proven ineffective at controlling the target exotic aquatic plant, DES, in consultation with others, may elect to recommend 'no action' at a particular site. Feasibility of control or control options may be revisited if new information, technologies, etc., develop.

If eradication, maintenance or containment is the recommended option to pursue, the following series of control techniques may be employed. The most appropriate technique(s) based on the determinations of the preliminary investigation will be selected.

Guidelines and requirements of each control practice are suggested and detailed below each alternative, but note that site specific conditions will be factored into the evaluation and recommendation of use on each individual waterbody with an infestation.

A. Hand-Pulling

- Can be used if infestation is in a small localized area (sparsely populated patch of up to 5' X 5', single stems, or dense small patch up to 2' X 2').
- Can be used if plant density is low, or if target plant is scattered and not dense.
- Can be used if the plant could effectively be managed or eradicated by hand-pulling a few scattered plants.
- Use must be in compliance with the Wetlands Bureau rules.

B. Mechanically Harvest or Hydro-Rake

- Can not be used on plants which reproduce vegetatively by fragmentation (e.g., milfoil, fanwort, etc.) unless containment can be ensured.
- Can be used only if the waterbody is accessible to machinery.
- Can be used if there is a disposal location available for harvested plant materials.
- Can be used if plant depth is conducive to harvesting capabilities (~ <7 ft. for mower, ~ <12 ft. for hydro-rake).
- If a waterbody is fully infested and no other control options are effective, mechanical harvesting can be used to open navigation channel(s) through dense

plant growth.

C. Herbicide Treatment

- Can be used if application of herbicide is conducted in areas where alternative control techniques are not optimum due to depth, current, use, or density and type of plant.
- Can be used for treatment of exotic plants where fragmentation is a high concern.
- Can be used where species specific treatment is necessary due to the need to manage other plants
- Can be used if other methods used as first choices in the past have not been effective.
- A licensed applicator should be contacted to inspect the site and make recommendations about the effectiveness of herbicide treatment as compared with other treatments.

D. Restricted Use Areas (per RSA 487:17, II (d))

- Can be established in an area that effectively restricts use to a small cove, bay, or other such area where navigation, fishing, and other transient activities may cause fragmentation to occur.
- Can not be used when there are several "patches" of an infestation of exotic aquatic plants throughout a waterbody.
- Can be used as a temporary means of control.

E. Bottom Barrier

- Can be used in small areas, preferably less than 10,000 sq. ft.
- Can be used in an area where the current is not likely to cause the displacement of the barrier.
- Can be used early in the season before the plant reaches the surface of the water.
- Can be used in an area to compress plants to allow for clear passage of boat traffic.
- Can be used in an area to compress plants to allow for a clear swimming area.
- Use must be in compliance with the Wetlands Bureau rules.

F. Drawdown

- Can be used if the target plant(s) are susceptible to drawdown control.
- Can be used in an area where bathymetry of the waterbody would be conducive to an adequate level of drawdown to control plant growth, but where extensive deep habits exist for the maintenance of aquatic life such as fish and amphibians.
- Can be used where plants are growing exclusively in shallow waters where a drawdown would leave this area "in the dry" for a suitable period of time (over

winter months) to control plant growth.

- Can be used in winter months to avoid encroachment of terrestrial plants into the aquatic system.
- Can be used if it will not significantly impact adjacent or downstream wetland habitats.
- Can be used if spring recharge is sufficient to refill the lake in the spring.
- Can be used in an area where shallow wells would not be significantly impacted.
- Reference RSA 211:11 with regards to drawdown statutes.

G. Dredge

- Can be used in conjunction with a scheduled drawdown.
- Can be used if a drawdown is not scheduled, though a hydraulic pumping dredge should be used.
- Can only be used as a last alternative due to the detrimental impacts to environmental and aesthetic values of the waterbody.

H. Biological Control

- Grass carp cannot be used as they are illegal in New Hampshire.
- Exotic controls, such as insects, cannot be introduced to control a nuisance plant unless approved by Department of Agriculture.
- Research should be conducted on a potential biological control prior to use to determine the extent of target specificity.

Appendix B Summary of Control Practices

Restricted Use Areas and Fragment Barrier:

Restricted Use Areas (RUAs) are a tool that can be use to quarantine a portion of a waterbody if an infestation of exotic aquatic plants is isolated to a small cove, embayment, or section of a waterbody. RUAs generally consist of a series of buoys and ropes or nets connecting the buoys to establish an enclosure (or exclosure) to protect an infested area from disturbance. RUAs can be used to prevent access to these infested areas while control practices are being done, and provide the benefit of restricting boating, fishing, and other recreational activities within these areas, so as to prevent fragmentation and spread of the plants outside of the RUA.

Hand-pulling:

Hand-pulling exotic aquatic plants is a technique used on both new and existing infestations, as circumstances allow. For this technique divers carefully hand-remove the shoots and roots of plants from infested areas and place the plant material in mesh dive bags for collect and disposal. This technique is suited to small patches or areas of low density exotic plant coverage.

For a new infestation, hand-pulling activities are typically conducted several times during the first season, with follow-up inspections for the next 1-2 years or until no re-growth is observed. For existing infestations, hand-pulling may be done to slow the expansion of plant establishment in a new area or where new stems are removed in a section that may have previously been uninfested. It is often a follow-up technique that is included in most management plans.

In 2007 a new program was created through a cooperative between a volunteer monitor that is a certified dive instructor, and the DES Exotic Species Program. A Weed Control Diver Course (WCD) was developed and approved through the Professional Association of Dive Instructors (PADI) to expand the number of certified divers available to assist with hand-pulling activities. DES has only four certified divers in the Limnology Center to handle problems with aquatic plants, and more help was needed. There is a unique skill involved with hand-removing plants from the lake bottom. If the process is not conducted correctly, fragments could spread to other waterbody locations. For this reason, training and certification are needed to help ensure success. Roughly 100 divers were certified through this program through the 2010 season. DES maintains a list of WCD divers and shares them with waterbody groups and municipalities that seek diver assistance for controlling exotic aquatic plants. Classes are offered two to three times per summer.

Diver Assisted Suction Harvesting

Diver Assisted Suction Harvesting (DASH) is an emerging and evolving control technique in New Hampshire. The technique employs divers that perform hand removal actions as described above, however, instead of using a dive bag a mechanical suction device is used to entrain the plants and bring them topside where a tender accumulates and bags the material for disposal. Because of this variation divers are able to work in moderately dense stands of plants that cover more bottom area, with increased efficiency and accuracy.

Mechanical Harvesting

The process of mechanical harvesting is conducted by using machines which cut and collect aquatic plants. These machines can cut the plants up to twelve feet below the water surface. The weeds are cut and then collected by the harvester or other separate conveyer-belt driven device where they are stored in the harvester or barge, and then transferred to an upland site.

The advantages of this type of weed control are that cutting and harvesting immediately opens an area such as boat lanes, and it removes the upper portion of the plants. Due to the size of the equipment, mechanical harvesting is limited to water areas of sufficient size and depth. It is important to remember that mechanical harvesting can leave plant fragments in the water, which if not collected, may spread the plant to new areas. Additionally harvesters may impact fish and insect populations in the area by removing them in harvested material. Cutting plant stems too close to the bottom can result in re-suspension of bottom sediments and nutrients. This management option is only recommended when nearly the entire waterbody is infested, and harvesting is needed to open navigation channels through the infested areas.

Benthic Barriers:

Benthic barriers are fiberglass coated screening material that can be applied directly to the lake bottom to cover and compress aquatic plant growth. Screening is staked or weighted to the bottom to prevent it from becoming buoyant or drifting with current. The barriers also serve to block sunlight and prevent photosynthesis by the plants, thereby killing the plants with time. While a reliable method for small areas of plants (roughly 100 sq. ft. or less), larger areas are not reasonably controlled with this method due to a variety of factors (labor intensive installation, cost, and gas accumulation and bubbling beneath the barrier).

Targeted Application of Herbicides:

Application of aquatic herbicides is another tool employed for controlling exotic aquatic plants. Generally, herbicides are used when infestations are too

large to be controlled using other alternative non-chemical controls, or if other techniques have been tried and have proven unsuccessful. Each aquatic plant responds differently to different herbicides and concentrations of herbicides, but research performed by the Army Corps of Engineers has isolated target specificity of a variety of aquatic herbicides for different species.

Generally, 2,4-D (Navigate formulation) is the herbicide that is recommended for control of variable milfoil. Based on laboratory data this is the most effective herbicide in selectively controlling variable milfoil in New Hampshire's waterbodies.

A field trial was performed during the 2008 summer using the herbicide Renovate to control variable milfoil. Renovate is a systemic aquatic herbicide that targets both the shoots and the roots of the target plant for complete control. In this application it was dispersed as a granular formulation that sank quickly to the bottom to areas of active uptake of the milfoil plants. A small (<5 acre) area of Captains Pond in Salem was treated with this systemic herbicide. The herbicide was applied in pellet form to the infested area in May 2008, and showed good control by the end of the growing season. Renovate works a little more slowly to control aquatic plants than 2,4-D and it is a little more expensive, but presents DES with another alternative that could be used in future treatments.

During the summer of 2010, DES worked with other researchers to perform field trials of three different formulations of 2,4-D in Lake Winnisquam, to determine which product was most target-specific to the variable milfoil. Navigate formulation was used, as were a 2,4-D amine formulation, and a 2,4-D amine and triclopyr formulation (MaxG). Although the final report has not been completed for this study, preliminary results suggest that all three products worked well, but that Navigate formation may be the most target specific of all three.

Another herbicide, Fluridone, is sometimes also used in New Hampshire, mainly to control growths of fanwort (*Cabomba caroliniana*). Fluridone is a systemic aquatic herbicide that inhibits the formation of carotenoids in plants. Reduced carotenoids pigment ultimately results in the breakdown of chlorophyll and subsequent loss of photosynthetic function of the plants.

Other aquatic herbicides are also used in New Hampshire when appropriate (glyphosate, copper compounds, etc). The product of choice will be recommended based on what the target species is, and other waterbody-specific characteristics that are important to consider when selecting a product.

Extended Drawdown

Extended drawdown serves to expose submersed aquatic plants to dessication and scouring from ice (if in winter), physically breaking down plant tissue. Some species can respond well to drawdown and plant density can be reduced, but for invasive species drawdown tends to yield more disturbance to bottom sediments, something to which exotic plants are most adapted. In waterbodies where drawdown is conducted exotic plants can often outcompete native plants for habitat and come to dominate the system.

Some waterbodies that are heavily infested with exotic plants do conduct drawdowns to reduce some of the invasive aquatic plant density. During this reporting period both Northwood Lake (Northwood) and Jones Pond (New Durham) coordinated deep winter drawdowns to reduce growths of variable milfoil (the drawdown on Northwood Lake is primarily for flood control purposes, but they do see some ancillary benefits from the technique for variable milfoil control).

Dredging

Dredging is a means of physical removal of aquatic plants from the bottom sediments using a floating or land-based dredge. Dredging can create a variety of depth gradients creating multiple plant environments allowing for greater diversity in lakes plant, fish, and wildlife communities. However due to the cost, potential environmental effects, and the problem of sediment disposal, dredging is rarely used for control of aquatic vegetation alone.

Dredging can take place in to fashion, including drawdown followed by mechanical dredging using an excavator, or using a diver-operated suction dredge while the water level remains up.

Biological Control

There are no approved biological controls for submersed exotic aquatic plant at this time in New Hampshire.

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